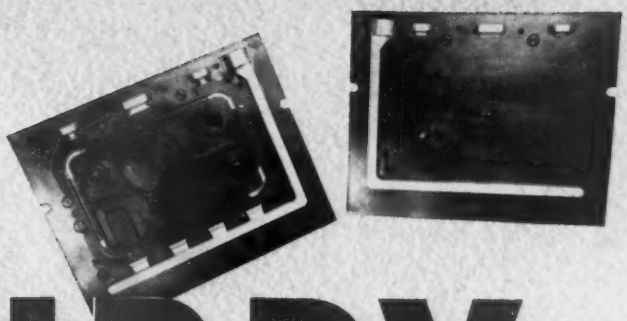
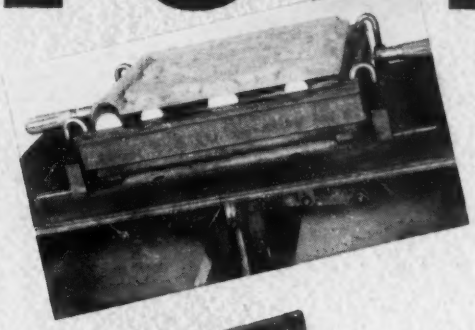
...NOLOGY DEPT.

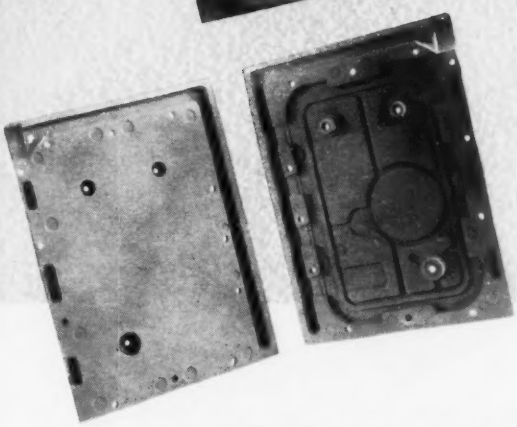


JUNE 1952

FOUNDRY

...WHEREVER METALS ARE CAST





The Shell Molding Process

—its mechanics and applications

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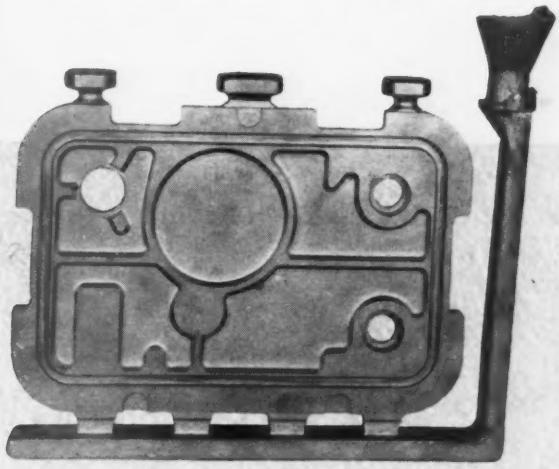

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Mechanization Can Aid the Smaller Plant—page 124

MORE FINISHED CASTINGS PER TON OF METAL POURED

with

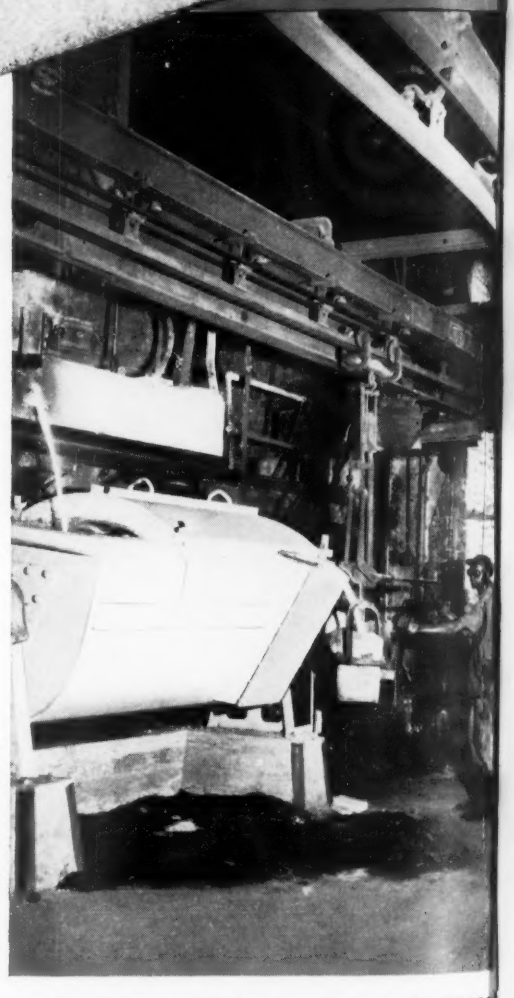
PURITE—100% Fused Soda Ash. The Scientific Flux for Better Melting and Cleaner Iron

PURITE—is sold by all leading foundry supply houses in the United States and Canada

Like so many modern foundries, the Stockham installation relies on Purite to help produce the quality iron needed for their valves and fittings. For cleaner, sounder iron castings... for ladle desulphurizing and as a cupola flux... Purite has proved its efficiency and economy by its industry-wide acceptance for nearly 30 years.
These exclusive advantages show why –

1. Purite produces a higher percentage of finished castings per ton of metal poured.
2. Purite gives 100% fluxing action in the cupola – 100% desulphurizing action in the ladle.
3. Purite gets to all the iron quicker.
4. Purite is time-tested and proven for unsurpassed desulphurizing uniformity.
5. Purite comes in 2-lb. pigs and 2-oz. tablets – no weighing or measuring required.
6. Purite is 100% pure fused soda ash – you do not pay for inert materials.
7. Purite does not crumble – no waste – no dust.
8. Purite can be shipped in bulk carloads at substantial savings over bag shipments – is easily stored without deterioration.

Purite can help you cut casting losses. Write for the booklet, "Refining and Desulphurizing Cupola Iron"; it illustrates in detail the accepted ways in which Purite is most effective. Mathieson Chemical Corporation, Baltimore 3, Maryland.



Stockham Valves and Fittings uses Purite in this 10,000 lb. mixing and desulphurizing ladle in their grey iron foundry. The cast iron pipe fittings and iron valve parts made from this iron meet the requirements of ASTM A-126, Class B.

Mathieson
CHEMICALS

SERVING INDUSTRY, AGRICULTURE AND PUBLIC HEALTH

TECHNOLOGY DEPT.

NICKEL ALLOY IRONS develop improved properties

plus all the basic advantages of plain cast iron

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PLAIN GRAY IRON is, structurally, a steel matrix containing graphite flakes. Engineering, physical, processing and service properties are wholly dependent upon the character and disposition of these flakes, and upon the nature of the matrix.

The matrix of nickel alloyed irons closely resembles the pearlitic matrix found in high carbon steels, whereas the matrix of ordinary plain iron resembles that found in low carbon steels. Compositions of nickel alloy irons can be adjusted to reduce "chill" in thin sections without risk of forming "spongy" regions in heavy sections. This promotes uniform strength, improved machinability, pressure tightness and wear resistance.

Hardness in nickel cast irons results from improvement of the matrix. Chilled areas and hard carbides, which impair machinability, are obviated. Nickel improves response to heat treating. In fact, use of nickel alone or with other alloying elements plays an important part in meeting a variety of requirements.

Accordingly . . . nickel alloyed irons permit production of castings with high levels of the following properties:

Strength

Tensile and transverse strengths of castings are greatly increased by the addition of nickel to cast irons of properly adjusted base mixture. The ratio of compressive strength to tensile strength is retained. Greater uniformity of strength in thick and thin sections is achieved.

Elasticity

The elastic modulus increases with strength. In this respect nickel-containing irons of the high strength type possess good stiffness and do not deform permanently under loads that would be damaging to irons of lower elastic modulus.

Damping Capacity

The damping capacity inherent in gray cast iron is not impaired by the presence of nickel.

Wear Resistance

The uniformly pearlitic matrix of nickel cast irons appreciably improves wear resistance. The uniformly fine graphite flake distribution, achieved in suitably processed irons *without formation of a poor wearing dendritic condition*, affords optimum resistance to wear and galling.

Pressure Tightness

Characterized by dense grain structure and fine dispersion of graphite throughout, nickel alloy irons are close-grained and offer an extraordinary degree of pressure tightness under high hydrostatic pressures, without sacrificing machinability.

Applications

Heavy machinery frames and *beds* are typical of cast parts that benefit from the rigidity and good damping capacity of nickel cast irons. *Cylinder* and *pump liners, gears, dies, machine tool ways, saddles* and *tables* exemplify parts produced in nickel irons to assure greatly increased strength and wear resistance. And nickel alloyed iron is used for *heavy duty brake drums* to resist heat checking, thermal shock, wear and galling. The nickel cast irons are readily heat treated, and respond particularly well to flame and induction hardening.

At the present time, the bulk of the nickel produced is being diverted to defense. Through application to the appropriate authorities, nickel is obtainable for the production of engineering nickel cast irons for many end uses in defense and defense supporting industries.

The International Nickel Company, Inc.
Dept. F, 67 Wall St., New York 5, N. Y.

Please send me booklet entitled, "Guide to the Selection of Engineering Cast Irons."

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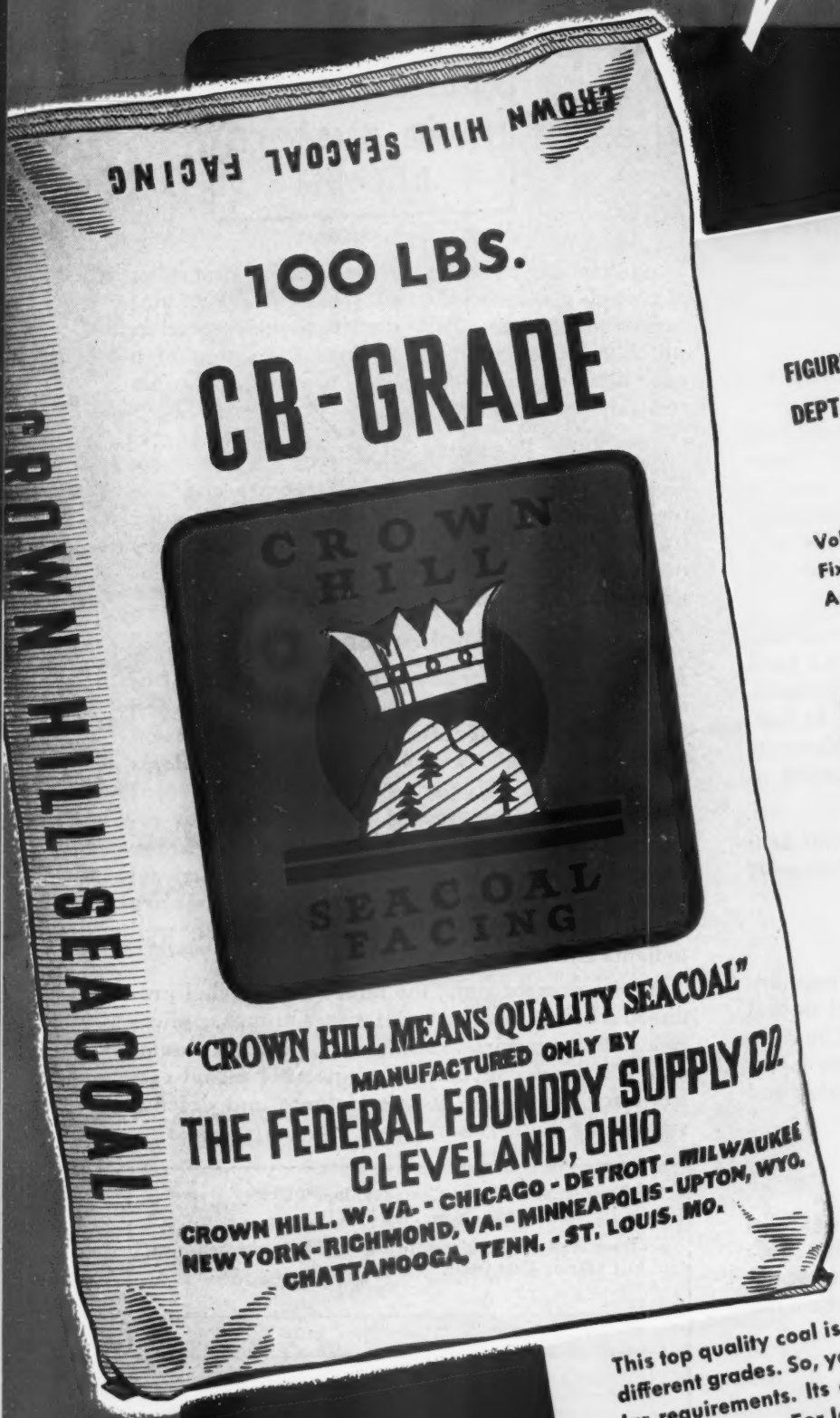
CROWN HILL MEANS *Quality* SEACOAL



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FIGURES FROM BUREAU OF MINES, DEPT. OF INTERIOR OF THE U. S.

(Moisture Free)

PROXIMATE ANALYSIS	
Volatile Matter	38.9%
Fixed Carbon	57.4%
Ash	3.7%
	100.0%

ULTIMATE ANALYSIS	
Hydrogen	5.4%
Carbon	82.0%
Nitrogen	1.6%
Oxygen	6.6%
Sulphur	.7%
Ash	3.7%
	100.0%

Fusion Point of Ash 2980° F

The quick-flash coal used in producing CROWN HILL comes from the heart of the West Virginia bituminous coal region.

This top quality coal is carefully pulverized and screened into seven different grades. So, you're sure to find a grade to meet your particular requirements. Its quick combustibility induces faster escape of gas and steam. For lower cleaning costs and better finish—always specify CROWN HILL.

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JUNE 1952

FOUNDRY

Volume 80—Number 6

NBP CCA

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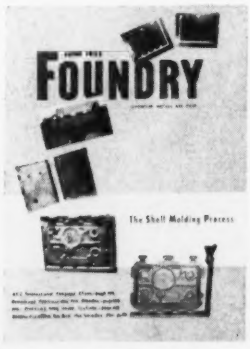

THE COVER: Depicting some of the steps between the pattern and casting in use of shell molds. See p. 112

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Photo by Torkel Korling

UCTOL

Best by Test for Rapid Baking

FOUNDRY RUNS EXTENSIVE TESTS ON NINE CORE OILS TO DETERMINE WHICH CAN DO THIS JOB BEST—

● Albion Malleable Iron Company of Albion, Michigan, had a serious problem. Core scrap was running much too high on this important automotive differential housing... and the source of the trouble was underbaked cores. The cores were baked in a tower oven, 67 minutes load-to-load. If the baking cycle slowed down, then the core room couldn't keep molding lines supplied.

Their problem: to find a core oil that would give strong, well-baked cores after *35 minutes* in the oven heat zone.

Albion's laboratory tested nine different core oils; recommended to the foundry that INDUCTOL would do the job. Production tests proved without a doubt that scrap losses on differential housing cores dropped *90%* when cores were made... *and well-baked*... with INDUCTOL.

Have you a baking problem that INDUCTOL can solve? Ask your LINOIL man about it, or write direct for more information.

LINOIL CORE OILS

Just off the Press

New Technical Bulletin entitled, "FACTS ABOUT THE LINOIL 700 SERIES" is yours for the asking.

Explains in detail the relationship of six newly-developed core oils to sands, baking, cereals and cost... Write for Bulletin No. 510 TODAY!

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Foundry Products Division • 2191 West 110th Street • Cleveland 2, Ohio

Pangborn

For detailed descriptions of these outstanding features, see columns at right.

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ELEVATOR DRIVE
ABRASIVE ELEVATOR (BELT AND BUCKET TYPE)
ABRASIVE SEPARATOR
SEPARATOR TO DUST COLLECTOR
REMOVABLE SCREEN TRAY
ABRASIVE STORAGE HOPPER
VISIBLE ABRASIVE OVERFLOW
BARREL TO DUST COLLECTOR
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SPUR GEAR REDUCER FOR WORK CONVEYOR WITH AUTOMATIC THROW-OUT IN CASE OF JAM
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HARDENED ROLLER CHAIN AND METAL SLAT CONVEYOR
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WORK CONVEYOR TAKE UP
WORK CONVEYOR SHAFTS ON ANTI-FRICTION BEARINGS
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ABRASIVE CONTROL HANDLE

Featuring famous Pangborn ROTOBLAST *that saves you money these 5 ways!*

SAVES LABOR with push-button operation

SAVES SPACE because machines are compact

SAVES TIME by cleaning more loads per day

SAVES TOOLS because all scale is removed

SAVES POWER since no compressor is needed

NEW ROTOBLAST® BARREL

Gives Higher Production at Lower Cost!

Check the outstanding features that make this possible!

- A Batch Cleaning Barrel of advanced design that uses the famous ROTOBLAST cleaning efficiency.

- Work Conveyor will not clog. Hardened steel chain with special metal slats designed so no aperture will pinch work.
Drives through V-Belt to Spur Gear-Reducer mounted directly on work conveyor shaft—simple—effective—safe.
Take-Up is on bottom shaft where weight of conveyor makes it easier to adjust.

- Automatic Throw-Out Torque Arm protection disengages the barrel drive in case of jams. Works in both loading and unloading directions.

- Abrasive-Tight Door and Housing *keeps abrasive within machine, permits economical use of the newer types of abrasives.*

- Abrasive-Tight Door. Woven wire mesh construction backed with vulcanized rubber. Rolls up compactly when door is opened. Slides on rollers in mechanized labyrinth. Always protected against abrasive action and tumbling castings by heavy rubber curtain.

- Cleaning and Reclaiming System—new—constantly removes all sand and debris, continuously maintaining full cleaning potential of abrasive.

- Work Loader—quick acting—double cables for safety—positively delivers entire load to machine.

- Control Panel—push button type—centrally located.

- Two Sizes Now Available—6 cu. ft. and 12 cu. ft. capacity. Other sizes on drawing boards.

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The whole industry's talking about the brand new Pangborn Rotoblast Barrel they saw demonstrated at the Foundry Show! And no wonder! Its many new features give it a cleaning efficiency that's unsurpassed! If you didn't have an opportunity to see this for yourself at the Show, write for further information about this new Barrel to: PANGBORN CORPORATION, 1400 Pangborn Blvd., Hagerstown, Maryland.

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BLAST CLEANS CHEAPER

with the right equipment for every job

NEW! STROMAN Revolving Tray CORE OVENS

Yes Sir, here they are... Stroman Revolving Tray Core Ovens for the baking of the smaller type of cores in both production and jobbing foundries. These ovens are Indirect Fired and incorporate the famous Stroman Recirculating Heat principle that assures the cleanest type bake as well as the most economical. No products of combustion can enter the baking chamber so cores are free from soot and other discolorating combustion gasses. The Stroman Revolving Tray Core Oven permits the cores to pass through all zones of heat in the oven, and provides the most uniform baking. Stroman Core Ovens are completely automatic in operation, all controls for complete oven operation are at the operator's finger-tips. All operating Mechanism and combustion equipment is concealed behind sliding doors and is kept free from dust, etc. Trays are *completely stabilized,* and will not swing, jitter, or sway. A tray indicator tells the operator where every tray is at all times. Heavy insulation makes it a very cool oven to work around. Split doors make it unnecessary to open the complete oven at one time. When these doors are lowered they form a convenient rest for the core boards while charging. There is a high temperature light in the oven that gives perfect light for bake inspection.

All in all they are the most efficient core ovens for your foundry. They provide perfect heat for speedy but perfect core baking. Fired by gas, oil or combination—gas or oil burners, they will do your core baking better and at decided savings. Here are the sizes . . . one will fit your needs:

No. of Trays	Tray Sizes
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5	26" x 76"
5	26" x 96"
5	26" x 112"
7	26" x 96"
8	26" x 96"
8	26" x 112"

MANY SIZES READY FOR IMMEDIATE DELIVERY!

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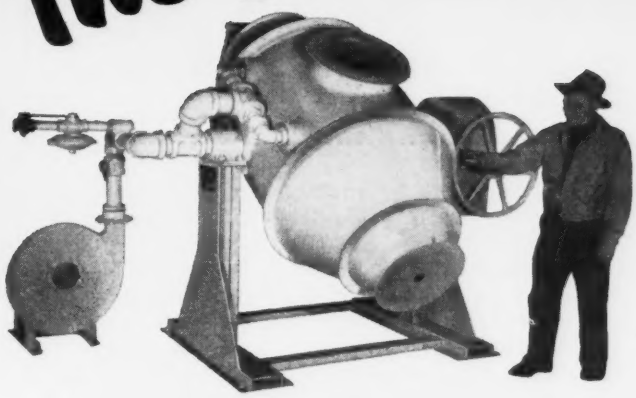
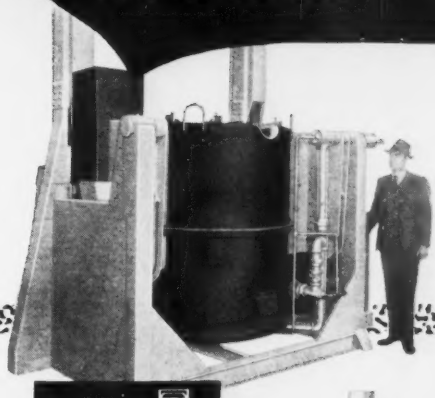
for Melting any type of Non-Ferrous Metals in Foundries, Die Casting and Permanent Mold Plants



STROMAN MODEL "BFC" HAND TILT BARREL TYPE MELTING FURNACE FOR ALUMINUM

Featuring "Tangential Firing" which produces a most efficient combustion condition, creating a melting atmosphere that keeps metal loss and dross accumulation at a minimum. Charges through the top or rear door which is also used for drossing metal and cleaning the furnace. Built in 500 lb. capacity and larger. Oil or gas fire.

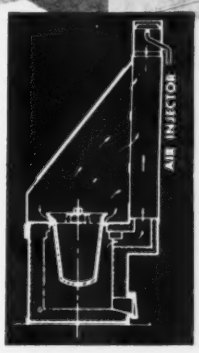


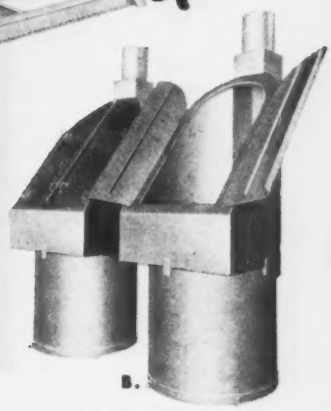
A.

STROMAN MAGNESIUM AND ALUMINUM MELTING AND HOLDING FURNACES

A. Hydraulic Tilt Magnesium and Aluminum melting furnace handling from 500 to 3000 lbs. of aluminum. Incorporates the famous Stroman Stationary Lip Pour, which creates a constant pouring arc at any desired pouring speed. Saves time and metal.

B. Stationary Super-Heating or Melting Furnaces, Type S. F. Designed to deliver the correct super-heat to magnesium after it has been melted in larger furnaces, and before it is poured into the molds. Can also be used for breakdown or holding. They have all safety features. Are available for cast steel pots or fabricated steel pots. Furnaces may be equipped with hoods if so desired, for the venting of combustion and other gasses. Write for bulletin No. 100.





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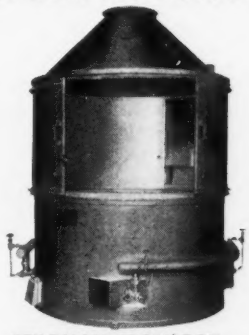

STROMAN IRON POT MELTING FURNACES FOR ZINC OR ALUMINUM

These furnaces are highly recommended as breakdown furnaces for zinc and aluminum die casting and permanent mold plants. They also excel as holding furnaces. They can be supplied either with or without hoods to exhaust fumes and heat. Their construction causes longest pot life and lowest fuel costs. Choice of automatic or manual controls and oil or gas fire. Capacities from 212 to 14,000 lbs. zinc.

Write for Bulletin No. 115

STROMAN HAND TILT CRUCIBLE MELTING FURNACE FOR BRASS, BRONZE, ALUMINUM AND OTHER ALLOYS

Capacities from No. 40 to No. 500 Crucible. Most efficient in operation. Rugged construction assures longest life and trouble-free operation. Oil, Gas or Combination Fire.

Write for Bulletin No. 105

STROMAN TYPE "MC" ALUMINUM DIP-OUT REVERBERATORY FURNACE

Bath capacity from 500 to 10,000 lbs. Aluminum

A combination of breakdown and holding furnaces makes this the most economical furnace ever designed for aluminum melting. It can be used for melting, holding, alloying, fluxing, for either casting or producing ingots. Cold metal does not reach the molten bath. Hot metal is always available for dipping. No iron pots or crucibles to buy. Oil, gas or combination oil-gas fire. Complete automatic controls are available if desired.

WRITE FOR COMPLETE CATALOGUE ON ALL TYPES OF FOUNDRY EQUIPMENT

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DIVISION OF

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This belt ran over 2 years at 500° F.

Imperial Sahara Belts are unsurpassed for handling hot materials

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What's your belting problem?

Such service records are not unusual for Imperial's Sahara Belting. If you use belting to handle high-temperature materials, it will pay you to let our engineers submit their recommendations on new installations or replacements. Imperial Belting always costs less to use because it's engineered specifically for the job to be done.

Made of 37½-ounce tight woven duck, with special impregnation and insulation, *Standard Sahara* handled materials up to 300° F.; *Insulated Sahara,* up to 450° F.; *Super Insulated Sahara,* up to 600° F. Imperial's inner-locked stitching positively prevents ply separation. Write for Data Sheet 47-8 and price list.

Imperial BELTING CO.

1755 S. KILBOURN AVE., CHICAGO 23, ILL.

Engineered Belting—
The Right Belt for Each Job

With the EDITORS

OLD FRIENDS: Even an old timer at these meetings of foundrymen, with a record of 20 foundry shows and 30 annual AFS conventions, experiences a thrill in the opening of another exhibition of foundry equipment and supplies. This may be due to the ever growing attractiveness of these displays, the noise of the machines in operation, or to the realization that much in the way of new machines and materials will be found in the various exhibits. Of course, these are the magnets which draw the crowds, but that feeling of well being comes more from the people who are there. Nothing can compare with the satisfaction that comes from greeting old friends and making new acquaintances as the show gets under way. And this year we had more than our share of happiness.

—o—

Thanks: Many of you called at our booth, and many more greeted numerous members of the FOUNDRY family as they moved about the auditorium at Atlantic City. We saw you on the boardwalk, at the various technical sessions, and at the social functions, and from these contacts developed the pleasant memories of the 1952 International Foundry Congress and Show. So thanks so much for your many kindnesses.

—o—

Congratulations: The Congress and Show at Atlantic City will go down in history as one of the most successful conventions and exhibitions in the history of the AFS. President Walter Seelbach, Vice President Dick Wagner, Secretary Bill Maloney, Technical Director Sil Massari, Convention and Exhibits Manager Al Hilbron, and the other members of the AFS staff should take considerable pride in the excellence of the planning and the smoothness with which the week's events moved along.

—o—

Local Help: From our position on the sidelines, it seemed that the Atlantic City Convention Bureau did much to facilitate the smooth handling of the convention, and that a special vote of thanks should go to Wayne Stetson of that organization. For many years, Wayne was connected with the Cleveland Convention and Trade Show Bureau, and helped handle three foundry shows. With this background of experience, he was able to direct his part of the affair exceptionally well. Thanks, Wayne, for your hard work and fine co-operation with the industry.

—o—

Daughter: And we should report that the lovely lady you noticed helping Art Tuscany in the Foundry Equipment Manufacturers' Association booth was Wayne's charming daughter, Mary Louise.

—o—

Service: The fine photographs of the Congress and Show reproduced in this issue were made possible through the splendid co-operation of Fred Hess & Son, official photographers

(*Concluded on page* 12)

This table at the Alumni dinner will not appear in the photograph of the affair, thanks to a large post. But we thought you might want to know the people Ed Hoyt arranged there. From left to right: John Grennan, retired instructor, University of Michigan; Mrs. Grennan; Alice Ellen Kennedy, daughter of Bob and Nellie Kennedy; John Howe Hall, consultant and author of many articles in *Foundry;* Lucille Wise; Gertrude Hall; John D. Wise of Pangborn; Suzanne Delport of London, the editor and Hilda Steinebach

INTERESTED IN *Reducing* SCRAP LOSS?

try Harbison-Walker's

Refractory Strainer Cores

Many foundries have reduced scrap loss and improved their castings by adopting Harbison-Walker Refractory Strainer Cores. Made of a hard, strong ceramic material, moulded under pressure and kiln-fired at a high temperature, they are uniformly accurate in shape and size, cleanly formed, non-spalling, erosion-resistant and economical.

With equivalent gate diameters ranging from ⅜-inch to 1½-inch, Harbison-Walker Refractory Strainer Cores in seven sizes provide for all normal requirements.

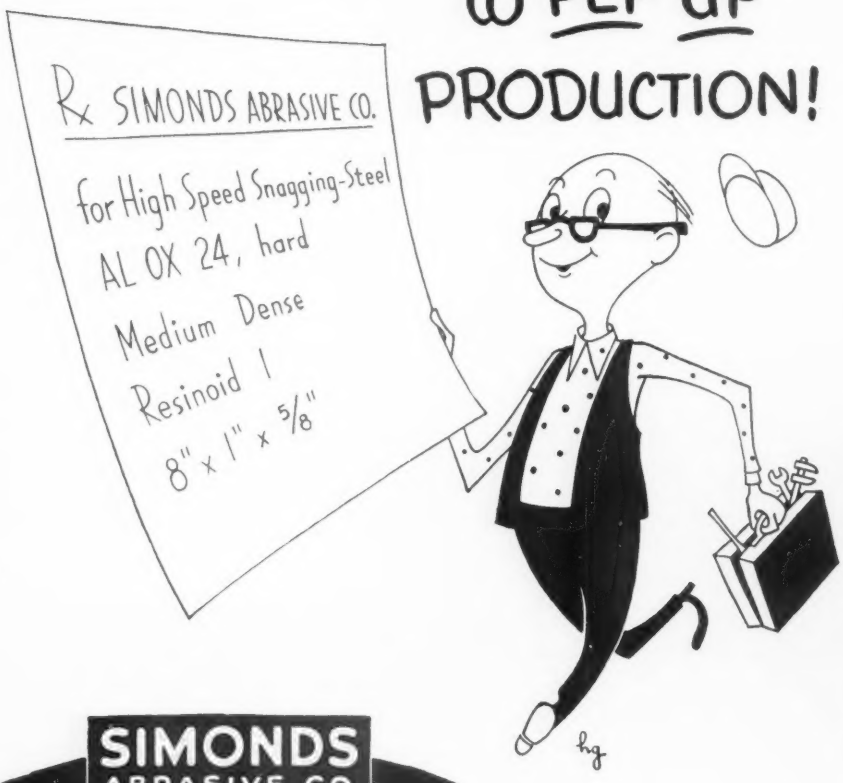
Cleaner castings are made when Harbison-Walker Refractory Strainer Cores are used; chipping, welding and grinding are substantially reduced; scrap losses are decreased; production is increased and labor costs are reduced.

Now available for prompt shipment, Harbison-Walker Refractory Strainer Cores are packed in sturdy cartons of a size and shape most convenient for the moulder. Write for bulletin describing this modern aid to economical foundry operation.

HARBISON-WALKER REFRACTORIES COMPANY AND SUBSIDIARIES

World's Largest Producer of Refractories
General Offices: Pittsburgh 22, Pa.

Here's a prescription to PEP UP PRODUCTION!



SIMONDS ABRASIVE CO.

Grinding Wheels

Simonds Abrasive Borolon wheel, Resinoid bonded for high speed grinding! That's the meaning of *this* prescription . . . an effective one for detouring trouble during grinding operations. Chances are you'll find the right prescription for *your* grinding headaches in our free data book. It lists wheel specifications for all your grinding jobs and gives details on Simonds' complete line, including mounted wheels and points, segments and abrasive grain. Let's send it to you together with the name of your nearby Simonds Abrasive distributor. Write.

SIMONDS ABRASIVE CO., PHILADELPHIA 37, PA. BRANCH WAREHOUSES: CHICAGO, DETROIT, BOSTON
DISTRIBUTORS IN PRINCIPAL CITIES

Division of Simonds Saw and Steel Co., Fitchburg, Mass. Other Simonds Companies: Simonds Steel Mills, Lockport, N. Y., Simonds Canada Saw Co., Ltd., Montreal, Que. and Simonds Canada Abrasive Co., Ltd., Arvida, Que.

(*Concluded from page* 10)

for the congress. In all our years of convention coverage, we have never had any better assistance than was provided by this Atlantic City organization. We want to express special thanks to Syd Stoen, who made most of the shots, and to Sadie Hess, who saw to it that the prints were delivered on time.

—o—

Presentation: Fathers and grandfathers got a bang out of the toy Payloader which recently has been developed and was shown at the booth of the Frank G. Hough Co. This sturdy toy, which operates much the same as its larger counterpart, soon will be on sale at toy stores. The illustration shows R. P. Wiggers, advertising manager of Hough, presenting one of the toy Payloaders to the editor. (We report that this will be sent along to grandson, Frank C. Steinebach, whose father is in foundry work up Detroit way.)

—o—

Who Won: During the week, drawings were held at the Hough booth for a number of these toys. A partial list of winners is as follows: Joey V. Ruiz Jr., Devorn Displays, Cleveland; Mrs. J. Haynes, Todd Shipyard Corp., Great Neck, N. Y.; B. H. Marks, Pangborn Corp., Detroit; D. S. Jaquith, Pangborn Corp., Buffalo; J. T. Mooney, National Engineering Co., Philadelphia; R. R. King, Paxton-Mitchell Co., Omaha, Nebr.; Gene Passman, Frederic B. Stevens Co., Detroit; Raymond Bowers, Boyers Foundry, and Mr. Abrams, Unitcast Corp., Toledo.

—o—

Another Contest: Drawings for clocks conducted during the show by Laclede-Christy Co., St. Louis, and associated companies, resulted in the following winners: James H. McGough, Magnolia Metal Co., Elizabeth, N. J.; J. H. Bruher, Eastern Malleable Iron Co., Wilmington, Del.; and B. R. Drews Jr., Decatur Foundry Inc., Decatur, Ill. F. G. S.

COLEMAN TOWER* OVENS

provide maximum production in minimum space...

Coleman Tower Ovens, with patented open center, increase oven loading accessibility and improve productivity of coremakers. Labor saving up to 75% is obtained by eliminating trucks, racks and other handling methods. Coleman Tower Ovens use only 25% of the space required for batch-type ovens of the same core capacity.

Coleman Tower Ovens can meet accelerated demands for cores despite limitations of labor and space. Our engineers are available, without obligation, to show you how. Write for Bulletin 48.

Only COLEMAN TOWER OVENS offer all these advantages:

EFFICIENT HANDLING METHODS eliminate delays and losses.

PERFECT CORE BAKING ends manpower and casting losses due to make-overs and rejects.

INCREASED PRODUCTION by making the most efficient use of skilled and unskilled labor.

SUPERIOR WORKING CONDITIONS...cores are cooled and smoked-off before leaving oven.

HEAVY DUTY CONSTRUCTION for continuous dependable performance and economical operation.

GREATEST SAVINGS IN FUEL by using the most economical fuel available.

SAVE BINDER. Proper core baking atmosphere and uniform temperature permit important savings in conventional binders.

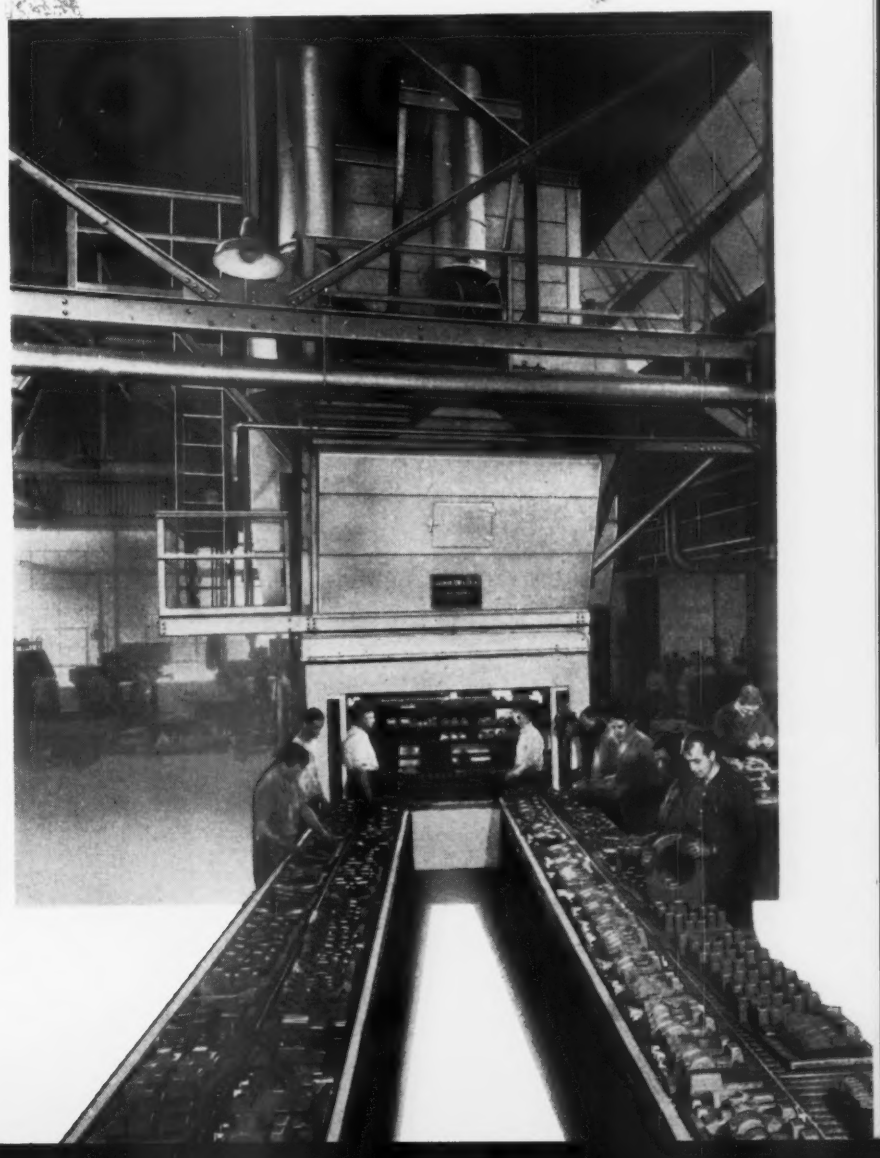
USE HIGH SPEED CORE BINDERS. Coleman ovens have uniform temperature and accurate control to handle temperature-sensitive resins; pre-baked oils.

50 YEARS OF FOUNDRY OVEN SPECIALIZATION IN EVERY COLEMAN OVEN

*Trademark

A COMPLETE RANGE OF TYPES:

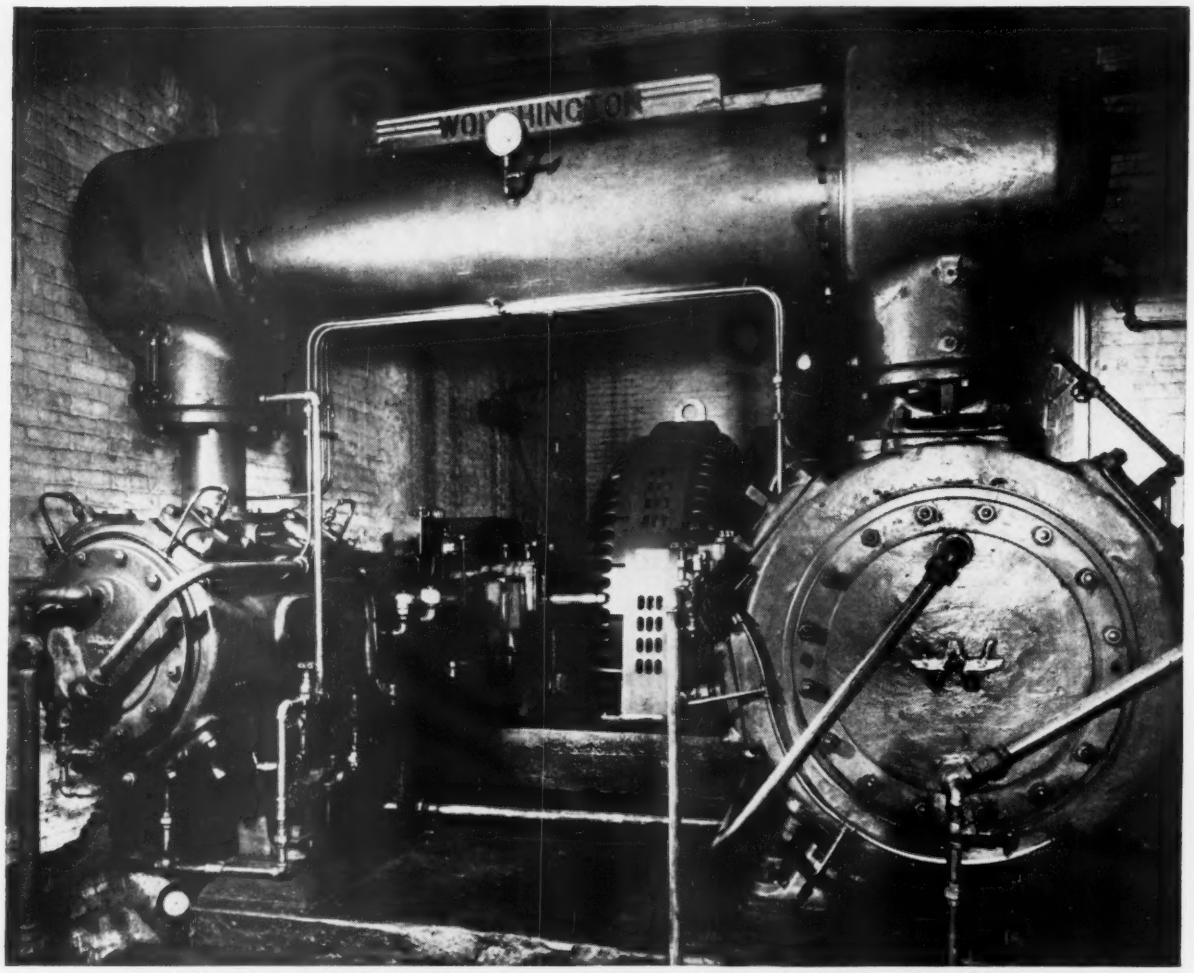
COLEMAN OVENS are built in a complete range of sizes and capacities for every core-baking and mold drying requirement: Tower Ovens, Horizontal Conveyor Ovens, Car-Type Ovens, Transrack Ovens, Rolling Drawer Ovens, Portable Core Ovens, Portable Mold Dryers, etc.



The Foundry Equipment Co.

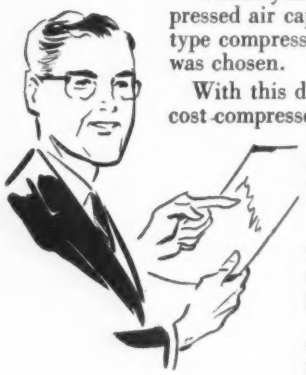
1831 COLUMBUS ROAD, CLEVELAND 13, OHIO

World's Oldest and Largest Foundry Oven Specialists



Worthington DC-2 horizontal air compressor at Lynchburg Foundry Co., Lynchburg, Va.

It Saves Power Costs At Every Load



When Lynchburg Foundry Co. wanted additional compressed air capacity . . . more than its Worthington Y-type compressor could handle . . . a Worthington DC-2 was chosen.

With this duplex compressor, Lynchburg gets lowest-cost compressed air and longest compressor life.

LESS DEMAND ON MOTOR WHEN THERE'S LESS DEMAND FOR AIR

Five-step capacity control permits matching the pumping rate to the varying amounts of air required. This reduces power consumption at partial load.

Worthington's five-step capacity control governor is exceptionally sensitive because it performs *only pilot duty*. The actual unloading is done electrically and pneumatically. But the pumping rate is continuously under the *control* of the governor. With decrease or increase in demand, the governor causes the compressor to unload or reload in sequence.

Worthington's by-pass control also reduces operating temperatures, eliminating valve difficulties from carbon deposits, improving lubrication, and reducing cylinder wear.

Other features include Worthington's famous Feather* Valve (lightest, tightest, most efficient ever made) . . . and a high-efficiency intercooler which needs less water, less power, less attention.

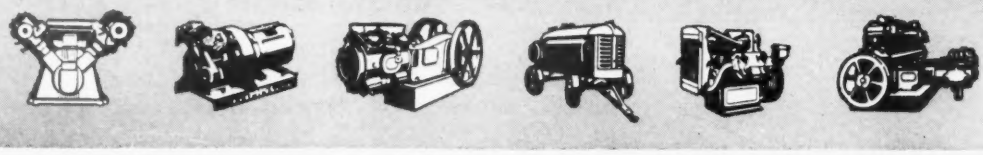
More proof *there's more worth in Worthington*, write for Bulletin L-675-BIB to Worthington Corporation, formerly Worthington Pump and Machinery Corporation, Compressor Division, Buffalo 5, New York.

WORTHINGTON

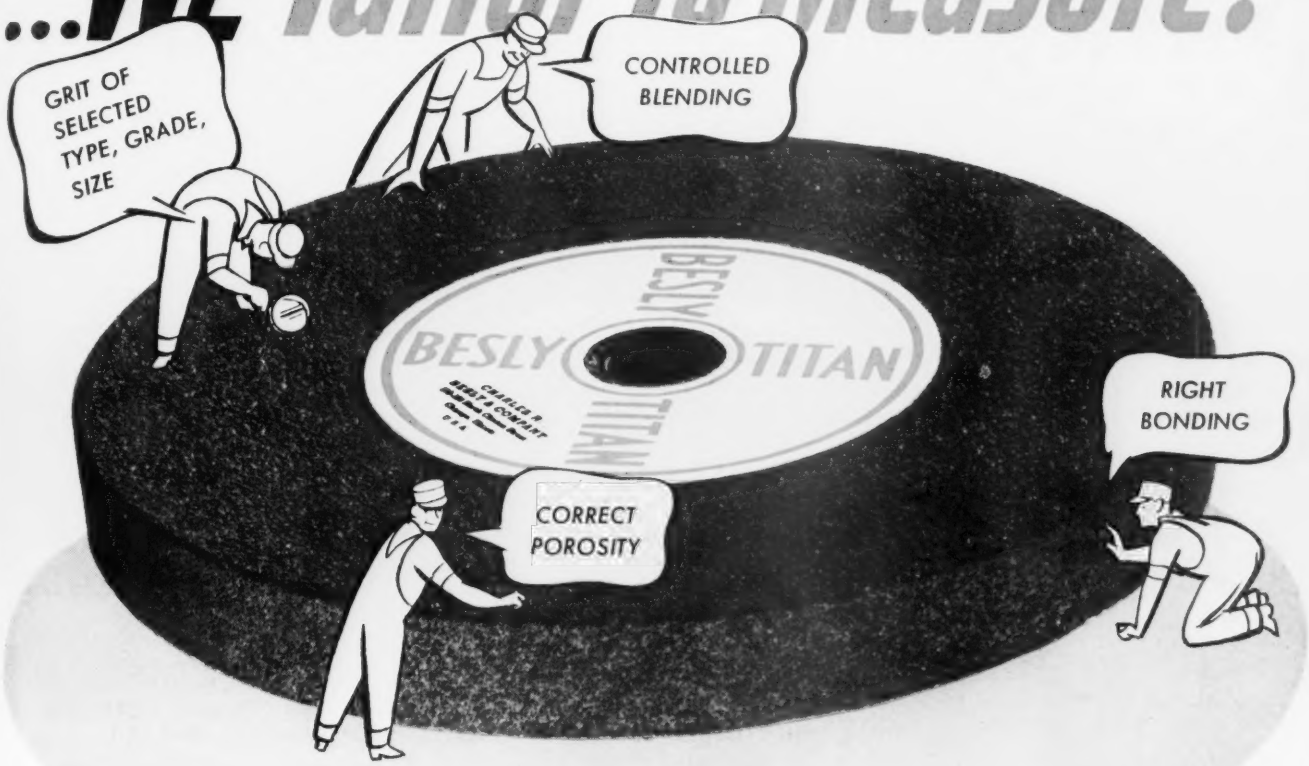
*Reg. U. S. Pat. Off.

K.1.6 f

NO OTHER AIR COMPRESSOR WILL OUTPERFORM A WORTHINGTON



You Measure Your Needs ...We "Tailor" to Measure!



Besly-Titan abrasive wheels and discs are JOB-FITTED for *your* jobs! Yes, JOB-FITTED for *your* jobs! It means exactly the right wheel or disc to match *your* work and the results *you* want!

Costing no more than ordinary stock wheels, Besly-Titans — with individual code numbers and formulas right on the "specs" — are delivering faster grinding at lower costs in foundries from coast-to-coast!

Original delivery, once "specs" have been established, is fast — really fast! And when you reorder, you do it by your own code number, assured that each wheel will be job-fitted to your particular needs.

BESLY TITAN

ABRASIVE WHEELS AND DISCS
Are "Job Fitted" for the Foundry

BESLY-WELLES CORPORATION
(Established as Charles H. Besly & Company in 1875)
20 No. Wacker Drive • Chicago 6, Illinois

BESLY-WELLES CORP.,
20 No. Wacker Dr., Chicago 6, Ill., Dept. F
☐ Please send details of Besly-Titan "Job-Fitted" Wheel Service.
☐ Also tell about Trial Order Plan.

NAME _____
COMPANY _____
ADDRESS _____
CITY _____ ZONE _____ STATE _____

...let's take a look at the 3F SIMPSON *MIX-MULLER* from the OPERATOR'S viewpoint

▶ *Put yourself on the mixer operator's platform* . . . and take a good look at the big-capacity 3F Simpson Mix-Muller from *his* viewpoint. He's interested in producing *big batches of uniformly high quality sand with a minimum of operating and maintenance attention.*

. . . And that's just what he gets with the 3F Simpson Mix-Muller. Specifically, here are some of the reasons why operators prefer Simpsons:

Easy access for adjustments and safe, routine maintenance . . . Vertical and radial plow adjustment easily made without entering mixer. Removable crib section permits all rotating machinery to be disassembled without disturbing foundation or overhead structures . . . and parts are removed in units without exposing gears or bearings.

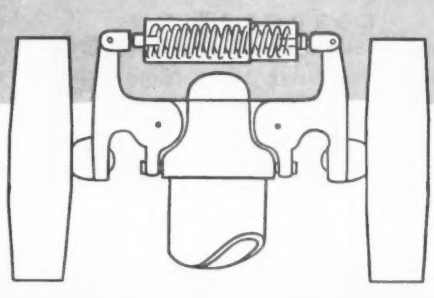
Safe, positive lubrication . . . Mullers and turret are grease-packed at the factory, and equipped with both labyrinth and friction type seals. Simple, dependable alemite centralized lubrication system serves mullers, rocker arm and turret—easily accessible from outside of mixer. Reducer is self-contained, splash lubricated.

Efficient utilization of power . . . Weight of the sand is carried on the bedplate, and discharge is handled by gravity through bottom doors—the only power required is that used to travel mullers over the sand and repile it in the muller path.

Most thorough mulling action ever developed . . . The comparatively lighter, *adjustable* mullers greatly increase the over-all efficiency of the mulling action, as the pressure can be adapted to the type of sand to be conditioned—and the 3F design permits handling at least 1/3 more capacity than previous models.

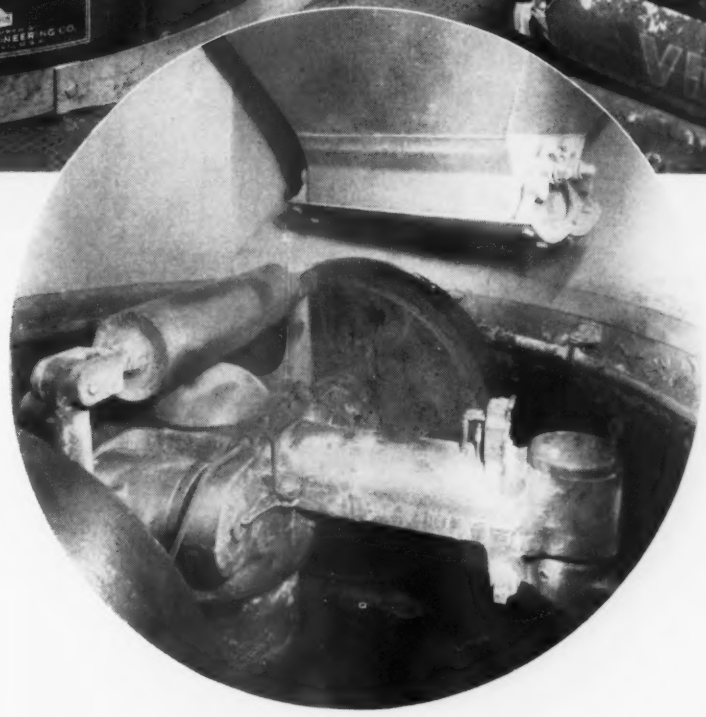
▶ Now, having examined the 3F Simpson Mix-Muller from the operator's platform, we think you can more readily see why these efficient units will give you greater tonnages of properly prepared sand . . . at lower operating and maintenance costs . . . and with fewer rejects, less scrap loss, and over-all improvement in casting quality.

Let our engineers prove what these high production Mix-Mullers can do for you . . . Write for BULLETIN 511.



Advantages of SPRING-LOADED MULLERS . . .

The spring loading arrangement of the mullers in the 3F Mix-Muller permits infinitely variable loading from 1,600 to 4,000 lbs. In the beginning of the mixing cycle the sand has little green strength and demands a light mulling weight. As the strength of the sand increases, the mullers rise and in turn exert a higher pressure on the deep sand bed beneath them. Because of the muller suspension and the plow design, the sand is subjected to much more violent agitation, and is considerably increased in volume. The agglomerate grains are broken up, any tendency to form "muller cake" is reduced, and a fluffy sand of high flowability results.



Here's the way the operator views the 3F Simpson Mix-Muller—in this case, at a large malleable foundry, where this high capacity unit is equipped with air-operated bond hopper and dust hood, charged from overhead batch hopper. The close-up view shows the streamline, dirt-tight design of the turret, spring-loaded mullers and rocker arm assembly, and part of the centralized lubrication system lines.

SIMPSON *Intensive* **MIX-MULLERS**

National Engineering Company

608 Machinery Hall Bldg. • Chicago 6, Illinois

Manufacturers and Selling Agents: For Continental European Countries—George Fisher, Ltd., Schaffhausen, Switzerland; for British Possessions—August's Limited, Halifax, England; for Canada—Dominion Engineering Co., Ltd., Montreal; for Australia and New Zealand—Gibson, Battle & Co., Pty., Ltd., Sydney, for Argentina, Brazil and Uruguay—Equipamentos Industriais EISA Ltda., Sao Paulo, Brazil; for Mexico—CASCO ,S. De R.L., Mexico, D.F.

As a leading supplier of tubing to builders and users of radiant tube furnaces, Pressed Steel Company's assemblies dependably furnish such general features as compactness, removability, uniform heating over tube length, etc. The distinctive feature of PSC radiant furnace tubes is their light-wall construction. Installation records repeatedly show that this feature effects marked economies in fuel and furnace time. Our "light-wall" construction is based on a quarter century's experience in precision fabrication of sheet alloys.

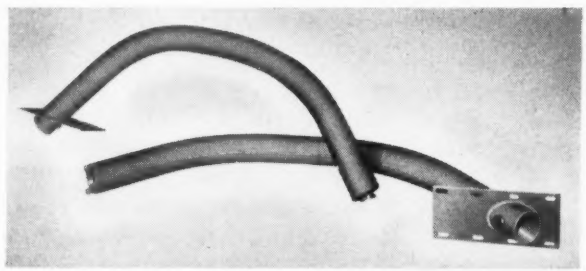
TUBE ASSEMBLIES FOR EVERY PURPOSE

Tubes for all types of radiant furnaces. We specialize in secondary burner tubes for highest temperatures. Let us show you how PSC light-wall tubes cut maintenance and furnace time.

PSC EQUIPMENT IS "ALLOY RIGHT"

Light-Weight **Heat-Treating Equipment for Every Purpose**

Carburizing and Annealing Boxes
Baskets · Trays · Fixtures
Muffles · Retorts · Racks
Annealing Covers and Tubes
Pickling Equipment
Tumbling Barrels · Tanks
Cyanide and Lead Pots
Thermocouple Protection Tubes
Radiant Furnace Tubes and Parts
Heat, Corrosion Resistant Tubing



We precision assemble the most complicated designs of radiant furnace tubes. Send blue prints or write as to your needs. We fabricate heat-treat units from the complete list of alloys. You can choose the metal that is "alloy-right" for your needs.

THE PRESSED STEEL COMPANY
of WILKES-BARRE, PENNSYLVANIA

Industrial Equipment of Heat and Corrosion Resistant WEIGHT-SAVING *Sheet Alloys*

☆ ☆ ☆ OFFICES IN PRINCIPAL CITIES ☆ ☆ ☆

Simple Solution

to a Purchasing Problem–

ORTAC hose that answers most of your needs!

THERE'S a simple answer to hose purchasing problems—Goodyear's ORTAC *(Oil Resistant Tube and Cover)*. For this ONE construction was designed by the G.T.M.—Goodyear Technical Man—to handle MANY jobs.

ORTAC will withstand gasoline, fuel oils and distillates. It resists attack from solvents. Contaminants found in water don't harm it. ORTAC is excellent too for air and spray service. Its cover resists sun, weather and wear—and ORTAC has a tube that won't flake, swell or discolor.

Ask your nearest distributor for the full story of ORTAC—or write Goodyear, Akron 16, Ohio.

GOODYEAR INDUSTRIAL RUBBER PRODUCTS
GTM - Specified ORTAC HOSE
for UNIVERSAL USE
A
B
C
A Synthetic tube resists gasoline, oils, distillates, solvents
B Braids of high-strength rayon cord
C Cover resists weather, oil, sun, abrasion

LOOK FOR YOUR GOODYEAR INDUSTRIAL RUBBER PRODUCTS DISTRIBUTOR *in the yellow pages of your Telephone Directory under "Rubber Products" or "Rubber Goods." He handles Hose, Flat Belts, V-Belts, Molded Goods, Packing, Tank Lining, Rubber-Covered Rolls built to the world's highest standard of quality.*

GOODYEAR

THE GREATEST NAME IN RUBBER

Ortac—T. M. The Goodyear Tire & Rubber Company, Akron, Ohio

CHAPLETS

Foundrymen have learned there will be no spoiled castings due to faulty Chaplets if they standardize on Shanafelt 'Seal-Tytes.'

Materials are metallurgically correct for thorough fusing in the casting. Uniformity in size of heads and stems is maintained by careful inspection. A full metallic coating keeps them rust proof while in your stock bins.

We specialize in double heads and keep large stocks of most sizes for immediate delivery.

STEEL FLASKS

For 27 years Shanafelt steel Flasks have been helping foundries pour good castings.

The Shanafelt Flask is strong, accurate, and long wearing, yet light in weight for easy handling.

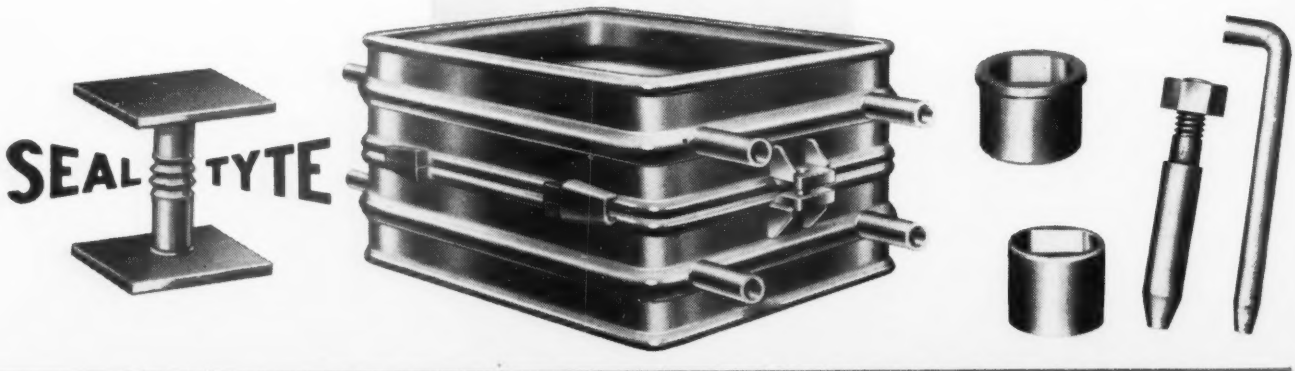
If you have never used Shanafelt Flasks, it will pay you to give them a trial—see for yourself how well they perform under your own production conditions.

FLASK PINS AND BUSHINGS

Shanafelt hardened steel Pins and Bushings are made for smooth and fast line up of the Flask sections.

Many years of Flask experience have taught us how they must be made to deliver results under today's high speed foundry operations.

Regardless of what Flask you are using, you'll make no mistake replacing worn bushings and pins with precision-made Shanafelts.



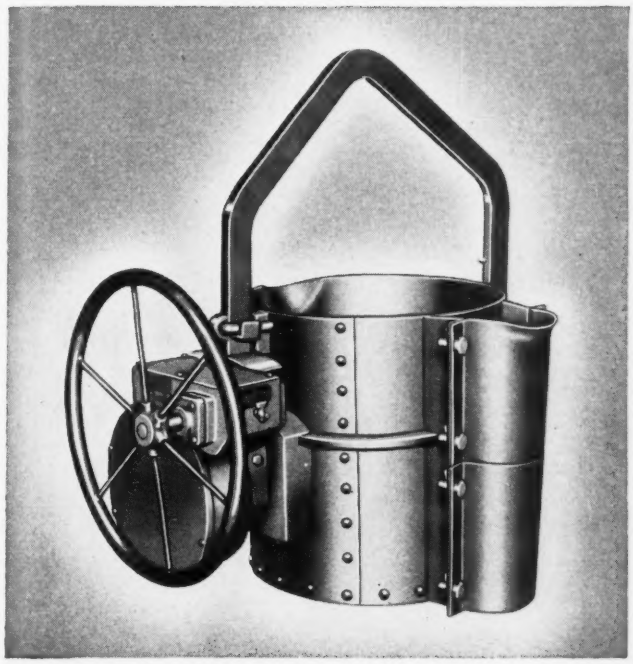
Dependable
SHANAFELT
Products

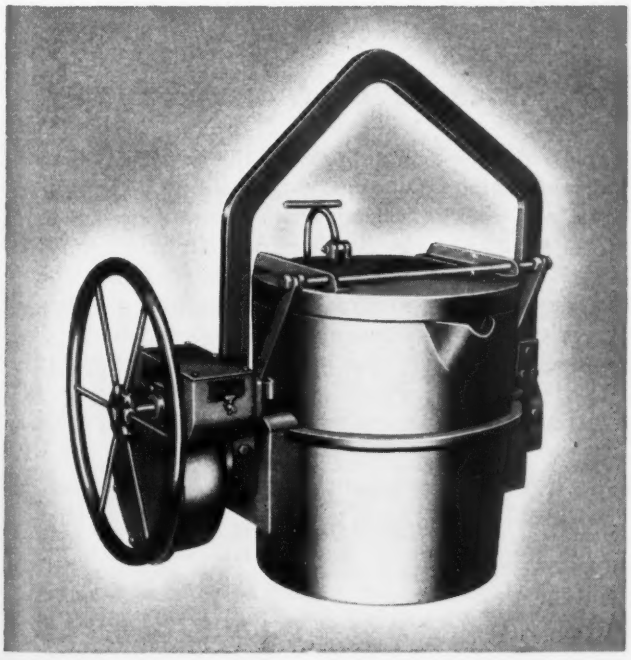
SERVING THE FOUNDRY INDUSTRY
FOR OVER 57 YEARS . . . . .

THE SHANAFELT MANUFACTURING CO., CANTON, OHIO
2600-2700 WINFIELD WAY N. E.

YOU'LL FIND THE TYPE LADLE YOU WANT AT

Ladle Headquarters



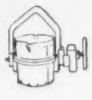


Industrial Equipment has all the ladles: teapot spout . . . covered . . . cylindrical . . . reservoir . . . buggy . . . bottom discharge . . . and many others, standard and special.

Each represents the last word in proven design and operating efficiency. All Industrial Crane Ladles are available with Industrial's revolutionary new universal bail which completely eliminates binding from heat or misalignment.

All geared ladles use Industrial's new hi-safety, self-locking worm gearing which uses no gaskets and which can be easily adjusted by anyone.

Write for Industrial's latest catalog. Illustrations, sizes, dimensions, technical features: all are included.



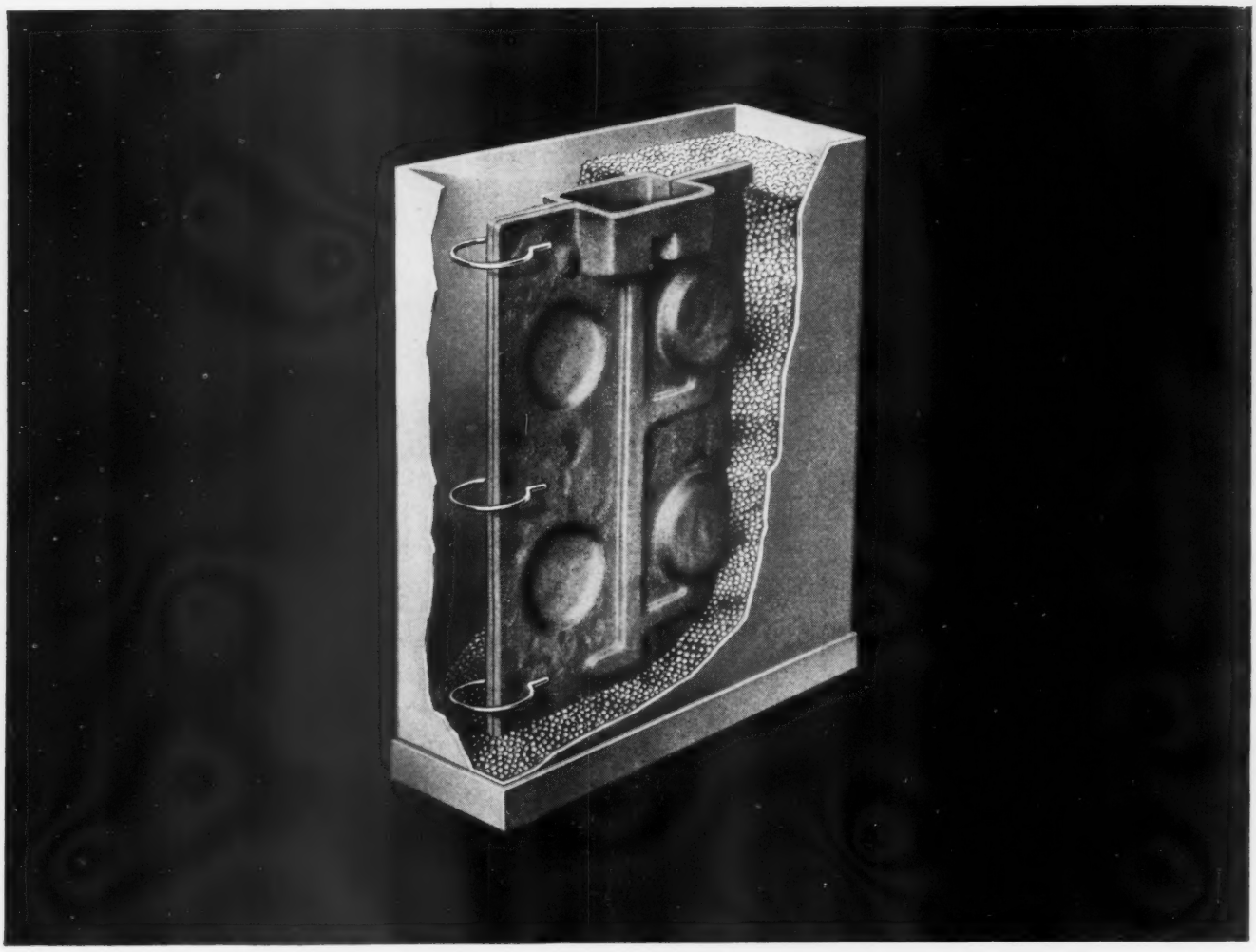
LADLES

SHANKS

BOWLS

TONGS

Industrial
EQUIPMENT COMPANY
115 NORTH OHIO ST., MINSTER, OHIO



5 STAR SAVER ★★★★★

Time Saver, Sand Saver, Scrap Saver, Space Saver, Money Saver

This is a sample sand mold produced by the shell molding process for making thin-shell molds and cores bonded with BAKELITE Phenolic Resins. The process not only yields better castings, but a greater number of castings per ton of metal poured.

It makes ferrous or non-ferrous castings with tolerances as close as .003 to .005 of an inch per inch. The fine-grain sands used give virtually pattern-smooth surfaces, minimizing finishing time and costs, and conserving metal.

Molds and cores are of uniform quality, highly porous, permitting escape of gases; strong, moisture-resistant and stable, with long storage life. Built-in dowel pins and holes assure accurate registration of the mold parts as the metal is poured.

Ninety per cent less sand is required, with important savings both in floor space and handling. And the process lends itself readily to mechanization resulting in more economical foundry operations.

For information about BAKELITE Phenolic Resins for the shell molding process, use the attached coupon.

Dept. CO-292, BAKELITE COMPANY,
A Division of Union Carbide and Carbon Corporation
30 East 42nd Street, New York 17, N.Y.

Please mail at once my free copy of the booklet C-8, "BAKELITE Phenolic Resins for the Shell Molding Process."

Name _____ *Title* _____

Company _____

Street _____

City _____ *State* _____

BAKELITE
TRADE-MARK
PHENOLIC
BONDING RESINS

TRADE MARK

BAKELITE COMPANY
A Division of
Union Carbide and Carbon Corporation
30 East 42nd Street, New York 17, N. Y.

In Canada:
Bakelite Company (Canada) Ltd., Belleville, Ont.

CARL-MAYER MOLD OVEN at Oil Well Supply Co., Oil City, Pa.

They put Big MOLD OVEN *jobs up to* CARL-MAYER

• • •

In Carl-Mayer design there is verification of our outstanding engineering know how—and your ensurance of highest operating efficiency.

One of our most recent large mold oven installations (shown at right) was chosen against several competitive makes—and its performance has won high praise from the owner.
For the biggest payoff, contact Carl-Mayer on your next job.

• • •

We build all sizes of Core and Mold Ovens, also other types of Industrial Ovens and furnaces. *Write for Bulletins 141 and 350.*

• • •

CARL-MAYER CORE AND MOLD OVENS ARE SERVING CONCERNS LIKE THESE:

Aluminum Co. of America
American Brake Shoe Co.
American Radiator Co.
Blaw-Knox Co.
Brown Industries
Buick Motor Div. of General Motors Corp.
Bucyrus-Erie Co.
Cadillac Motor Div. of General Motors Corp.
Columbia Steel Corp. (U. S. Steel Corp.)
Crucible Steel Castings Co.
Dunkirk Radiator Co.
Eclipse Aviation Division of Bendix Aviation Corp.
Electric Autolite Co.
Ford Motor Co.
Fremont Foundry Co.
G. & C. Foundry Co.
General Electric Co.
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General Steel Castings Co.
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Henry Kaiser Corp.
W. O. Larson Foundry Co.
Mesta Machine Co.
F. E. Meyers & Bro. Co.
Oil Well Supply Co. (U. S. Steel Corp.)
Packard Motor Car Co.
Pittsburgh Steel Foundry Corp.
H. B. Salter Co.
Shenango Penn Mold Co.
Standard Foundry Co.
Union Brass & Metal Mfg. Co.
Union Steel Castings Co.
West Michigan Steel Castings Co.
A. C. Williams Co.
Whiten Machine Works
Whiting Corp.

CARL-MAYER MOLD OVEN at Union Steel Castings Div. of Blaw-Knox Co. Door Clearance: 17'9" wide, 15' high. Depth: 40'. Capacity: 200 tons per bake. Combination Gas-Oil fired.

THE CARL-MAYER CORP.

3030 Euclid Ave., Cleveland, Ohio

Over 30 Years' Experience

You can get safer wheels and save money, too . . .

MANHATTAN REINFORCED CUT-OFF WHEELS

Castings that are too heavy to bring to stationary cut-off machines may now be safely cut with Manhattan Reinforced Cut-Off Wheels on swing-frames. The special lateral reinforcement enables Manhattan Wheels to perform under adverse conditions of side-strain far beyond the endurance of regular cut-off Wheels.

In addition to extra built-in safety, field reports indicate as much as 25% higher cleaning-room production with these wheels. For more and faster work per wheel, for greater safety in foundry cutting, insist on Manhattan *Reinforced* Cut-Off Wheels.

MR822

GRINDING WHEEL INSTITUTE MEMBER

WRITE TO ABRASIVE WHEEL DEPARTMENT

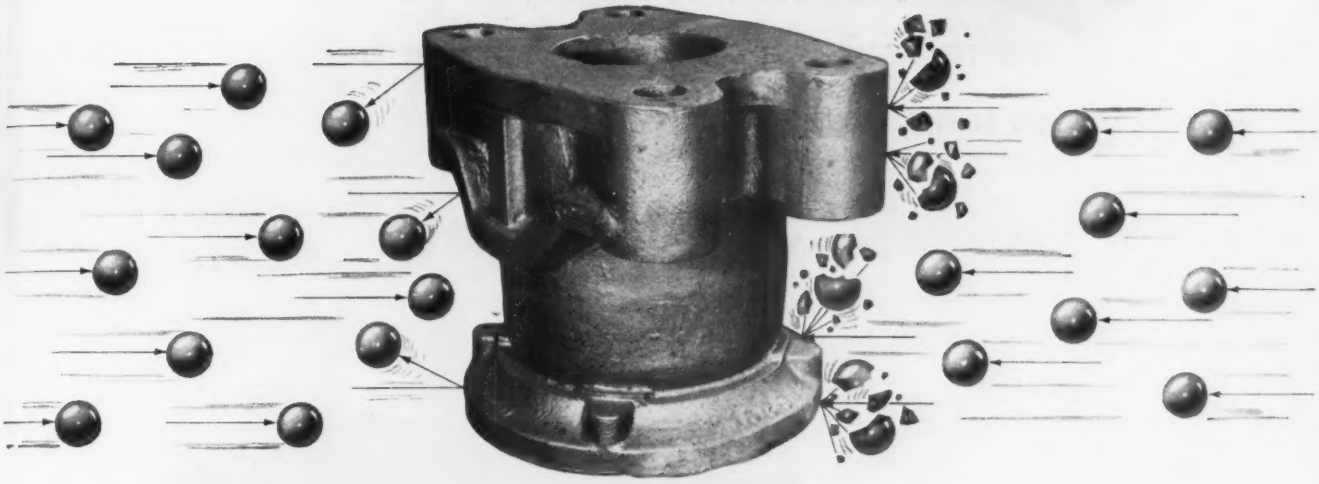
RM

MANHATTAN RUBBER DIVISION — PASSAIC, NEW JERSEY

RAYBESTOS-MANHATTAN, INC.

Manufacturers of Mechanical Rubber Products • Rubber Covered Equipment • Radiator Hose • Fan Belts • Brake Linings • Brake Blocks • Clutch Facings • Packings • Asbestos Textiles • Powdered Metal Products • Abrasive and Diamond Wheels • Bowling Balls

Shattered Shot Shatters Savings



TRU-STEEL NEVER SHATTERS

When abrasive shatters, as most abrasives do, your blast cleaning costs are bound to be greater. The number of passes before shattering determines the efficiency of an abrasive and accounts for the savings made by steel abrasives over ordinary chilled iron. Tru-Steel Shot NEVER SHATTERS. It maintains its size and shape longer, giving many more hours of efficient blast cleaning.

TRU-STEEL HAS THE ENDURANCE OF STEEL

Tru-Steel Shot lasts many times longer than other abrasives because it is made of tough, high-carbon steel. As a result, one pound of Tru-Steel cleans as much work as 3 to 6 pounds of iron abrasives that shatter.

TRU-STEEL HAS A FULL HEAT TREATMENT

To make Tru-Steel even tougher, it is fully heat-treated, not just drawn or annealed. This is another reason why it never shatters, why you have less abrasive to buy when you use Tru-Steel.

TRU-STEEL COSTS LESS TO USE

Other premium abrasives claim savings too, but comparative tests prove Tru-Steel's superiority. For example, the results of a typical test made by a prominent manufacturer show the following cost per hour:

Abrasive "A"	**$ .67**	**Abrasive "B"**	**$.978**
Abrasive "C"	**$1.33**	**Tru-Steel**	**.467**

Until you've tried Tru-Steel, you can't be sure the abrasive you are using is giving you maximum life at the lowest cost.

Bulletin 59-A shows where the average cleaning dollar is spent and how savings can be made. Send for your copy today.

American
WHEELABRATOR & EQUIPMENT CORP.
505 S. Byrkit St., Mishawaka Ind.

TRU-STEEL SHOT

Revolutionary last year ...superior to othe

contact wheels 2 to 1...Abrasive belts grind faster,

last twice as long, stay free from glaze

...Still More Revolutionary TODAY!

NEW "T-61"

UNIVERSAL HUB

CONTACT WHEEL

Look to CARBO

TRADE MA

"Carborundum" is a registered trademark of The Carborundum Company, Niagara Falls, N. Y.

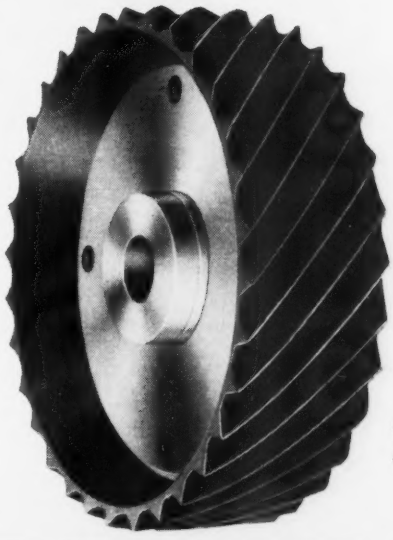
SERRATED "TIRE"

"EXPLODED" VIEW

SIDE PLATE

"TIRE"

HUB



COMPLETE ASSEMBLY

WHAT New "T-61" Hub Wheel can cut your contact wheel replacement costs squarely in half.

HOW Three part, simple assembly...Universal Hub and Side Plate—"T-61" serrated rubber "tire". When "tire" wears out, throw it away and replace with new tire at half the cost of entire new wheel.

WHY Fast, flawless interchangeability. A single Hub will take 144 different tires of various width-and-hardness combinations. Each part of assembly is separately balanced—positive, perfect performance in any combination of Hub, tire and plate.

WHERE Everything from the roughest stock removal grinding to the finest flat or contoured surface finishing.

WHEN Right now! Switch to this new cost-cutter today... get in touch with your CARBORUNDUM or distributor salesman—or write to Dept. F 82-67.

RUNDUM

MARK

for the NEW developments in ALL abrasive methods

82-67

You make *deep cost-cuts* by grinding your steel castings...

...with Norton ALUNDUM* wheels

Whether you use swing grinders, floor stands, disc grinders or portable grinders to rough-grind your steel castings, you'll find a Norton ALUNDUM wheel that fits any grinding job in your foundry. So, cut the costs of cleaning by specifying these long lasting, fast cutting wheels.

Your Norton Distributor and Abrasive Engineer will be glad to work directly with you, helping you select wheels to fit such variables as: the condition and type of the casting... the area of wheel contact... the amount of pressure applied and heat generated... the type of grinding machine used.

These practical grinding men will be glad to tell you just which variety of ALUNDUM abrasive to use for your particular cleaning room jobs and which of the several outstanding Norton bonds (BH, B5 and B7 resinoid for high-speed operation, and BE vitrified for slow speed) will do your jobs best. Meanwhile, get your copy of the authoritative, illustrated, 48-page Norton booklet, "Rough Grinding." *Ask your nearby Norton Distributor* for FORM 1405 or write us direct. NORTON COMPANY, Worcester 6, Mass. Distributors in all principal cities. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Mass.

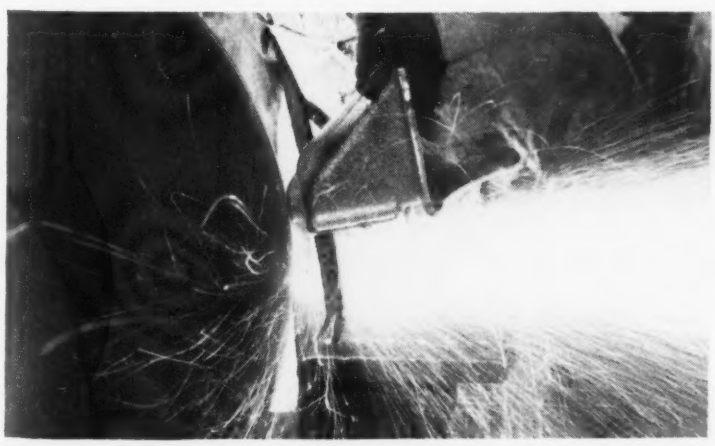
BE SURE OF FAST CUTTING ACTION . . . without sacrificing wheel life. Norton ALUNDUM wheels with BH, B5 or B7 resinoid bonds can take it because they are highly heat resistant.

GET TWICE THE EFFICIENCY from your floor or bench grinders by using Norton ALUNDUM wheels on both ends of your machines.

SNAG STEEL CASTINGS with portable grinding machines, using fast-cutting Norton ALUNDUM wheels.

YOU GET WORK DONE FASTER . . . at lower cost . . . when you use Norton wheels. Shown here, Norton ALUNDUM wheel grinding a sprocket.

STEP UP rate of stock removal from steel castings by use of pressure bar on floor grinders . . . keep handling time to a minimum.



NORTON

ABRASIVES

Making better products to make other products better

* Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

Tabor's Cope and Drag

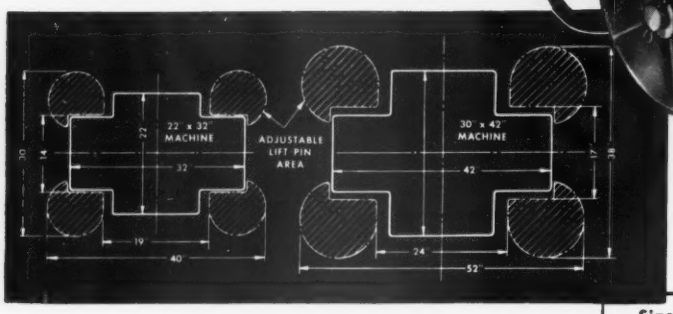
Matched M for Speed a

Each of these machines is a star performer in its own right. Working together, they're unbeatable for keeping cope and drag production in near-perfect balance.

ROLLOVER FEATURES — completely power operated; shockless machines completely portable up to 1000 lb. capacity; new jarring end designed for peak effectiveness; plain jar or shockless jar (*absolutely shock-free*); plate-locking device to stop all plate wobble or "secondary jolt"; quick change-over plate to protect against varying work; double air-operated clamps for top speed operation; internal jarring valve; complete cycle of operations in the *fractional part of a minute.*

JAR FLASK LIFT FEATURES — available in stationary or portable models; plain or shockless jar; adjustable flask lift pins to cover a wide range of flask lengths and widths (see diagram); Tabor's famous air-on-oil draw; working access from three sides.

PUT THEM TOGETHER IN YOUR FOUNDRY —and you have a team with ability and flexibility. They'll roll where you want them—meet critical schedules in the production shop—put high-production features into short-run work in the jobbing shop. And—traditional with Tabor—give long life at low up-keep.



Size of Machine	22" x 32"	30" x 42"
Capacity—80# Air	600#	1000#
Patt. Draw.—Plain Jar; Oil Controlled	10"	12"
Patt. Draw.—Shockless; Oil Controlled	9"	12"
Height Table from Floor—Portable	28"	32"
Height Table from Floor—Stationary	26"	30½"
Weight Shockless Jar	2600#	4000#
Weight Plain Jar	1900#	2700#

REPRESENTATIVES

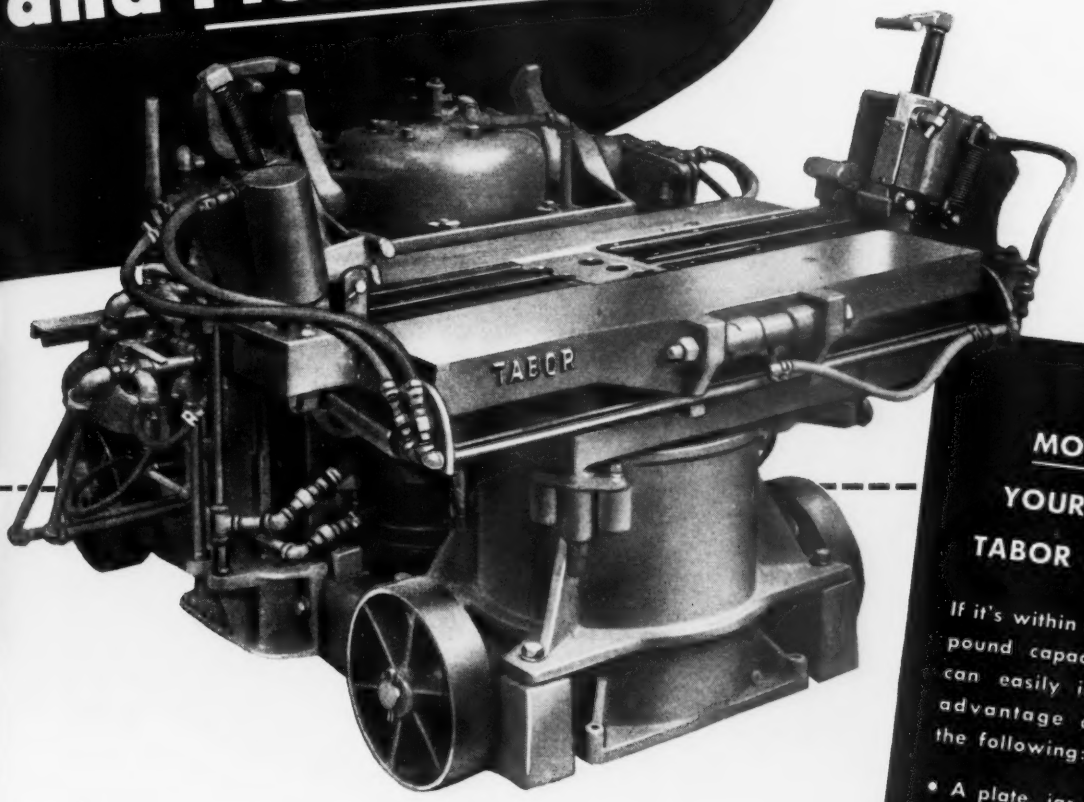
Snyder Foundry Supply Company, Los Angeles, Calif.; The Pacific Graphite Company, Inc., 40th & Linden Sts., Oakland 8, Calif.; Carl F. Miller & Company, Seattle, Washington; Harry H. Reich, Trussville, Ala.

save labor...

Size of Machines	Sizes of Rollover Plates		Length of Pattern Board when using Flask Clamps		Height Plate from Floor		Max. Space for over-all depth of Flask, Pattern Board and Bottom Boards	Draw	Capacity (lbs.)
	Width	Length	Min.	Max.	Plain Jar	Shockless Jar			
22"	22"	42"	16"	43"	25"	29"	17½"	10"	600 lbs.
30"	30"	40"	20"	53"	27¾"	32¼"	20½"	12"	1000 lbs.

Team . . .

Machines and Flexibility



MODERNIZE YOUR PRESENT TABOR ROLLOVER

If it's within the 600 to 3,000 pound capacity range, you can easily install to great advantage any or all of the following:

- A plate, jar head, and jar piston made of steel
- Plate-locking device
- Quick change-over plate and double clamps
- Air-operated mold receiver

The **TABOR** *Manufacturing Co.*

SINCE 1884 MANUFACTURERS OF FOUNDRY MOLDING MACHINES

6225 TACONY STREET • PHILADELPHIA 35, PENNA.

Export Department, 765 Drexel Bldg., Phila. 6, Pa.

. . . buy *Tabor*

FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION INC. MEMBER FEMA

MODERNIZE WITH A MULTI-WASH

DUST, SMOKE AND FUME REMOVAL SYSTEM

This self-liquidating improvement can step you up to new production records

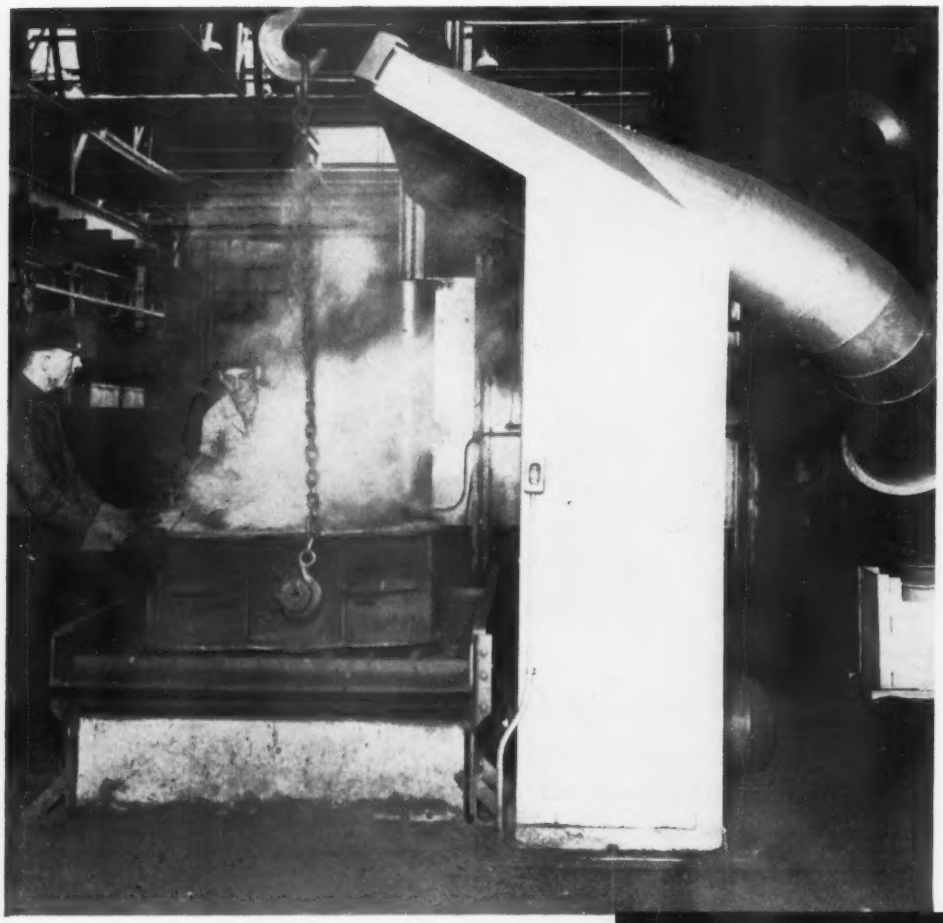
Today, more than ever, conditions make it imperative to increase efficiency in foundry operation in order to meet new production schedules and maintain a reasonable profit margin.

Many foundries have made substantial gains in both respects by modernizing with Multi-Wash. Replacing contaminated air with fresh, clean outside air has cut down turn-over of production personnel and given a noticeable lift to efficiency of operation. This naturally reflects in increased sales and profits.

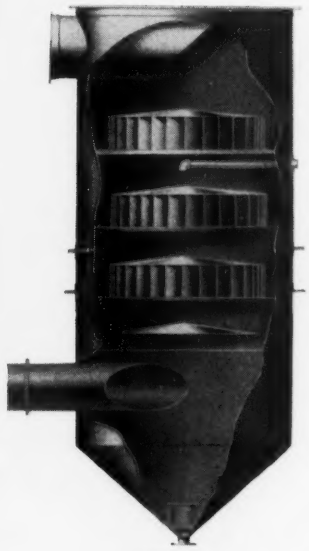
Why not consider this means of meeting competition? A Multi-Wash dust collecting system can give you *clean air everywhere.*

Call your local Schneible engineer or write direct for further information.

CLAUDE B. SCHNEIBLE COMPANY
P. O. Box 81, North End Station
Detroit 2, Michigan



Model JC Collector—For most shakeouts and sand preparation systems. Model IC Collector—For hot or dry shakeouts and most cleaning room applications. Model HC Collector—For highest collecting efficiency of extremely fine materials. *All models are made in ranges from 1000-36,000 c.f.m.*



FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION INC. MEMBER FEMA

PRODUCTS:

Multi-Wash Collectors • Uni-Flo Standard Hoods • Uni-Flo Compensating Hoods • Uni-Flo Fractionating Hoods • Water Curtain Cupola Collectors • Ductwork • Velocitrap • Dust Separators • Entrainment Separators • Settling and Dewatering Tanks • "Wear Proof" Centrifugal Slurry Pumps

SCHNEIBLE

MANUFACTURERS • ENGINEERS • CONTRACTORS

Late Foundry News

MAY 23, 1952

OVER THE HUMP: The worst appears over in raw materials supply and in effect of the defense program on the national economy. Some metals continue exceptions to the marked easing in supply the last few months, but greater quantities of steel and aluminum will be available for civilian use from now on. NPA has lifted restrictions on lead, cadmium, antimony, zinc and bismuth. On the other hand, copper, nickel and certain alloys remain relatively tight.

THE ROAD AHEAD: Production of military items will continue to increase, but the impact of the defense program will be softened by the enormous expansion in plant capacity and raw materials supplies since June, 1950. Actually, we are only half-way through the three-year program to create and equip 21 Army divisions, a 143-wing air force and a 408-ship Navy; however, we have reached two-thirds of the peak production scheduled for the military program.

HOW LONG CONTROLS?: NPA is attempting to quell the notion that the beginning of the end of consumption and distribution controls over materials means an early abandonment of all restrictions. While promising flexibility in the application of controls and their lifting when conditions warrant, government officials point out that new scarcities can and have developed as certain phases of the arms production program are reached. For instance, controls recently have been applied for the first time to selenium, cryolite, crushing bort and diamond powder. Pressure from outside Washington to lift price controls is growing, but how soon the various ceilings will be abandonded is thought likely to depend largely on how rapidly the restrictions on use of materials are waived.

METALLICS FREER: The supply picture in pig iron and scrap has changed markedly in recent months. Inventory controls over pig iron no longer are necessary, the Merchant Pig Iron Industry Advisory Committee told NPA recently in recommending their removal or at least an increase in the 60-day limit to a 90-day supply. The committee opposes pig iron exports until domestic consumers have ample inventories, but feels that merchant pig iron production, based on present and new facilities, will be more than ample to meet any foreseeable demand. At about the same time the scrap consumers committee advised NPA that the scrap situation is far better than at any time since April, 1951, and that allocation could be slackened. The committee warned, however, that capacity steel operations through this year likely would mean another shortage next winter. Consumers are urged to increase their inventories in anticipation of possible scarcities later.

ALUMINUM SURVEY: NPA is attempting to obtain a quick picture of potential aluminum casting capacity and recently queried a number of foundries on these points: Their production for February, March and April this year; peak capacity; how much they could increase their present capacity with existing equipment on strictly defense work, and on what basis — number and lengths of shifts—this additional production could be accomplished. The agency is anxious to obtain a prompt reply to its questionnaire.

CASTINGS FROM EUROPE: Steel foundries in Europe may supply some of the heavy castings needed in the defense program. Huge presses to make forgings and extrusions for aircraft parts require numerous castings weighing 50 to 150 tons. Because domestic steel foundries able to produce such castings already are heavily booked, representatives of DPA, NPA, the Air Materiel Command and the Loewy Construction Co., a press builder, went to Europe recently prepared to place orders there. A number of French and German foundries are said to have capacity available to handle the work.

TANK ARMOR: About $33 million will be spent to ready the government-owned steel foundry at Birdsboro, Pa., to produce cast tank armor under a subcontract from the Chrysler Corp. tank plant at Newark, Del. The foundry, operated during World War II by Birdsboro Steel Foundry & Macine Co., will be run this time by newly incorporated Birdsboro Armorcast Inc., headed by J. E. McCauley. Other officers are: Marshall Post and G. Clymer Brooke, vice presidents; James M. Heppenstall, treasurer, and Lester E. Leinbach, secretary. At peak operations the plan will employ 2500 in producing $3 million worth of tank armor monthly.

DIE CASTING PRICES UP: A 4 per cent increase in ceiling prices of die casting producers has been authorized by OPS. This followed a survey which indicated a decline in earnings the second half of 1951 as the result of increased production costs and lower sales volume.

MORE CAPACITY: Although this year probably will mark a peak in outlays for new plant facilities, a substantial volume of construction work is in prospect before existing programs are completed. Government-approved certificates of necessity for accelerated tax amortization totaled nearly $19 billion as of May 20 and involved 9830 new or expanded facilities. Recent approvals and amounts certified included these foundries: Turner & Seymour Mfg. Co., Torrington, Conn., $528,975; Seaboard Foundry Inc., Johnston, R. I., $38,055; General Foundry Corp., Corona, Long Island, N. Y., $28,712; Posey Iron Works Inc., Lancaster,

Pa., $28,791; Janney Cylinder Co., Philadelphia, $113,827; Superior Steel & Malleable Castings Co., Benton Harbor, Mich., $50,707; Paul M. Wiener Foundry Co., Muskegon, Mich., $55,604; Wellman Bronze & Aluminum Co., Cleveland, $81,876; Aluminum Casting & Engineering Co., Milwaukee, $29,540; Gunite Foundries Corp., Rockford, Ill., $39,319; General Motors Corp., Bedford, Ind., $238,929; General Motors Corp., Jones Mills, Ark., $3,194,324; Gardner-Denver Co., LaGrange, Mo., $100,000; Belknap Mfg. Co., Bridgeport, Conn., $157,493.

PERSONALS: H. A. Forsberg, vice president, Continental Foundry & Machine Co., East Chicago, Ind., is new president of the National Castings Council. Other officers elected recently include: Vice president, A. V. Martens, Pekin Foundry & Mfg. Co., Pekin, Ill.; treasurer, F. Ray Fleig, Smith Facing & Supply Co., Cleveland; secretary, Frank G. Steinebach, *Foundry* . . . Walter W. Edens, recently with Alloy Engineering & Casting Co., Champaign, Ill., has joined the sales engineering staff of Federated Metals Division, American Smelting & Refining Co. . . . Peter Markey, 62, one of the organizers of the Bohn Aluminum & Brass Corp., Detroit, died there May 18.

EXTRA ALLOTMENTS: Consumers pinched by low second quarter allotments have been granted supplementary allotments of more than 18,000 tons of copper products and 23,500 tons of aluminum. The former included more than 5000 tons of copper foundry products. Much of the extra metal became available through revised military requirements.

SHIPMENTS OFF: Castings shipments continue to run behind the rate a year ago. Bureau of Census reports March shipments of nonferrous castings were 20 per cent less than the 1951 month. Gray iron deliveries were off 18.5 per cent, malleable was down 21 per cent and steel dropped 5 per cent. Steel castings are the exception to the general decline in backlogs since last year.

MISCELLANY: Expanded facilities for making magnesium castings are planned for the government-owned Eclipse-Pioneer Foundry of Bendix Aviation Corp., Teteroro, N. J., following the recent transfer of the plant to the Navy . . . Refractories industry has increased its capacity 35 to 40 per cent since 1948, according to NPA . . . Freight car builders delivered 7403 cars in April. New orders totaled 397 cars, leaving a backlog of 108,270 . . . Inventories of purchased materials have declined for five consecutive months, a business survey of the National Association of Purchasing Agents shows.

PRICES OF FOUNDRY METALS AND COKE

(As of May 23, 1952)

FOUNDRY COKE

(Per net ton, f.o.b. ovens)

BEEHIVE	
Connellsville	$17.00-18.00
New River	21.30
Wise County	15.95
OVEN	
Birmingham	$20.30
Chicago	23.00
Detroit	24.00
Erie, Pa.	23.50
Everett, Mass.	24.80
Indianapolis	22.75
Kearney, N. J.	22.75
Milwaukee	23.75
Painesville, O.	24.00
Philadelphia	22.70
Neville Island (Pittsburgh)	23.00
Portsmouth, O.	22.50
St. Louis (delivered)	25.40
Swedeland, Pa.	22.60
Terre Haute, Ind.	22.50

PIG IRON

(Per gross ton, f.o.b. furnace)

	No. 2 Foundry	Malleable
Bethlehem, Pa.	$54.50	$55.00
Birmingham	48.88	....
Buffalo	52.50	53.00
Chicago	52.50	52.50
Cleveland	52.50	52.50
Everett, Mass.	57.50	58.00
Fontana, Calif.	58.50	....
Geneva, Utah	52.50	....
Granite City, Ill.	54.50	54.90
Lone Star, Tex.	48.50	48.50
Neville Island (Pittsburgh)	52.50	52.50
Steelton, Pa.	54.50	55.00
Swedeland, Pa.	56.50	57.00
Toledo, O.	52.50	52.50
Troy, N. Y.	54.50	55.00
Youngstown, O.	52.50	52.50

NONFERROUS INGOT

BRASS AND BRONZE: 85-5-5-5—27.25c; 88-10-2—40.00c; 80-10-10 — 33.00c; No. 1 yellow — 23.25c.

ALUMINUM: 99 per cent plus, primary ingots 19.00c. Secondary No. 12 alloy 19.50c Deoxidizing grades: No. 1 18.80c; No. 4 18.20c.

MAGNESIUM: 99.8 per cent standard ingots 24.50c, f.o.b. Freeport, Tex.

COPPER: Electrolytic 24.50c, Connecticut valley; Lake 24.61½c, delivered.

ZINC: High grade 20.85c, delivered. Die casting alloy 23.65c-24.25c, delivered.

IRON AND STEEL SCRAP

(Ceiling prices per gross ton as established by the Office of Price Stabilization)

	*No. 1 Bundles	Cast Steel	**Steel, 2 ft & less	Punchings, Plate Scrap	Cast Iron Briquets
Birmingham	$39.00	$44.00	$39.00	$41.50	$39.00
Buffalo	43.00	48.00	43.00	45.50	43.00
Chicago	42.50	47.50	42.50	45.00	42.50
Cincinnati	43.00	48.00	43.00	45.50	43.00
Cleveland	43.00	48.00	43.00	45.50	43.00
Detroit	41.15	46.15	41.15	43.65	41.15
Eastern Pa.	42.50	47.50	42.50	45.00	42.50
Los Angeles	35.00	40.00	35.00	37.50	35.00
Pittsburgh	44.00	49.00	44.00	46.50	44.00
San Francisco	35.00	39.00	35.00	37.50	35.00
St. Louis	41.00	46.00	41.00	43.50	41.00
Seattle	35.00	40.00	35.00	37.50	35.00

Above delivered prices are ceiling levels at basing points indicated. * Applies to dealer and industrial scrap; No. 1 and No. 2 heavy melting steel are $1 less; No. 1 railroad heavy melting is $2 higher. **$2 higher if 1 ft or under.

CAST IRON SCRAP

No. 1 cupola cast	$49.00
Heavy breakable cast	45.00
Burnt cast iron	41.00
Cast iron brake shoes	41.00
Stove plate	46.00
Clean auto cast	52.00
Unstripped motor blocks	43.00
Iron wheels, No. 1	47.00
Malleable	55.00
Drop broken machinery cast	52.00

Above ceiling prices, per gross ton, are f.o.b. shipping point. Add transportation charges to obtain delivered prices at any foundry.

MALLEABRASIVE®*

(SHOT AND GRIT)

When Eddie Gutkowski, Cleaning Room Foreman at General Foundries, Milwaukee, decided to try Malleabrasive, he hoped to realize a 50% savings on maintenance and parts. "Actually," Eddie reports, "we have saved more than that!" What's more, "Malleabrasive costs far less *per ton of castings cleaned!*" Ray Maas, Maintenance Superintendent, agrees completely. "Malleabrasive lasts much longer than any other abrasive we have ever used," he says. And it turns out a cleaning job like the one you see above!

SEND FOR FREE TEST KIT

These are just two of the many foundrymen who have found Malleabrasive a real time-and-money-saver. Remember—Malleabrasive is *guaranteed* to outperform ordinary shot and grit in fair comparative tests. Write today for your free kit containing all the forms you need to run an impartial test. Address: PANGBORN CORP., 1400 Pangborn Blvd., Hagerstown, Maryland.

Look to Pangborn for the latest developments in Blast Cleaning and Dust Control Equipment

Here's why Malleabrasive Saves You Money

MALLEABRASIVE

- *is designed for modern cleaning equipment*
- *wears out fewer machine parts*
- *lasts 2 to 4 times longer*
- *reduces cleaning costs up to 50%*
- *increases output of cleaned castings*

PLACE A TEST ORDER TODAY

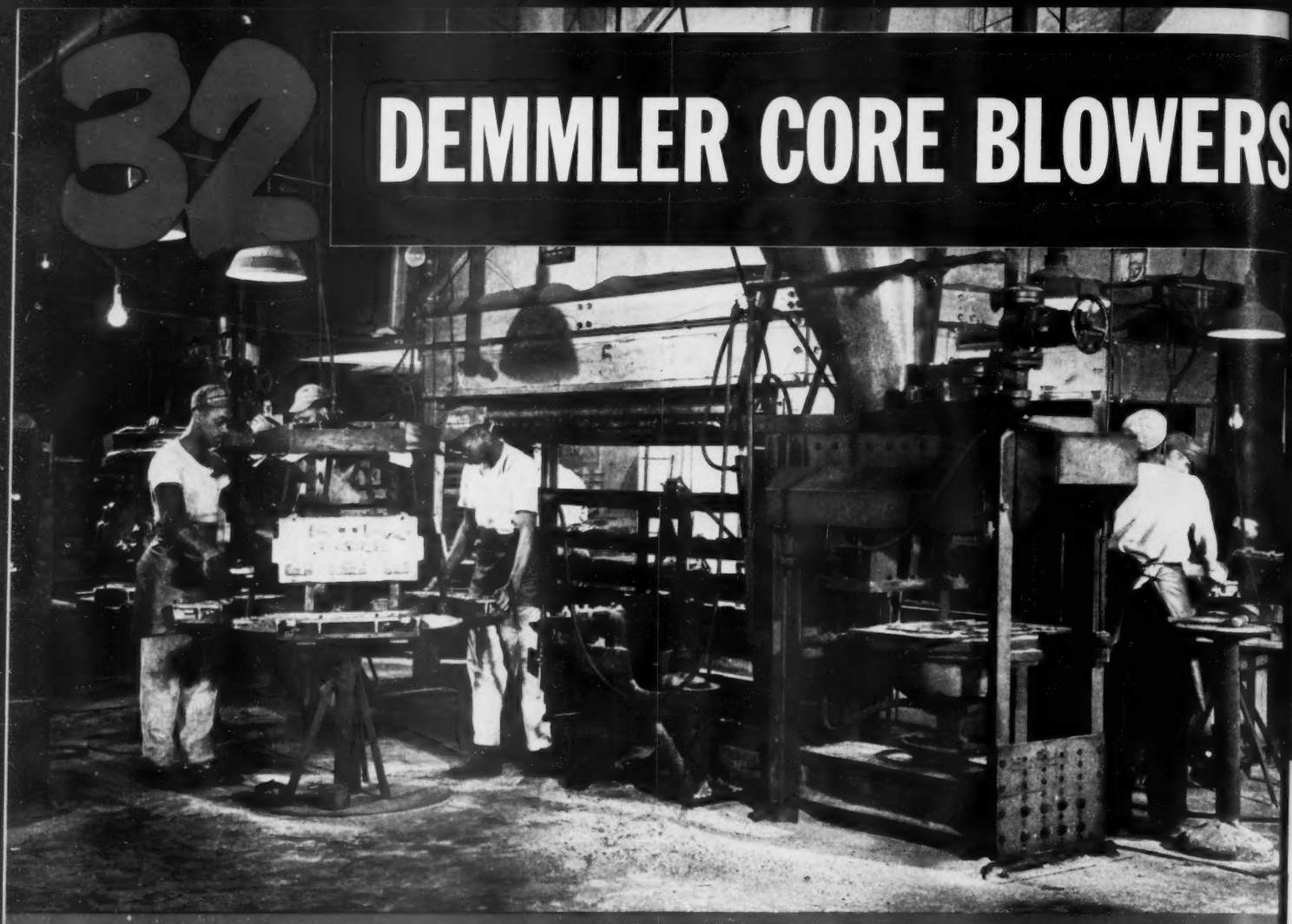
Packed in orange striped 100-pound bags with this tag

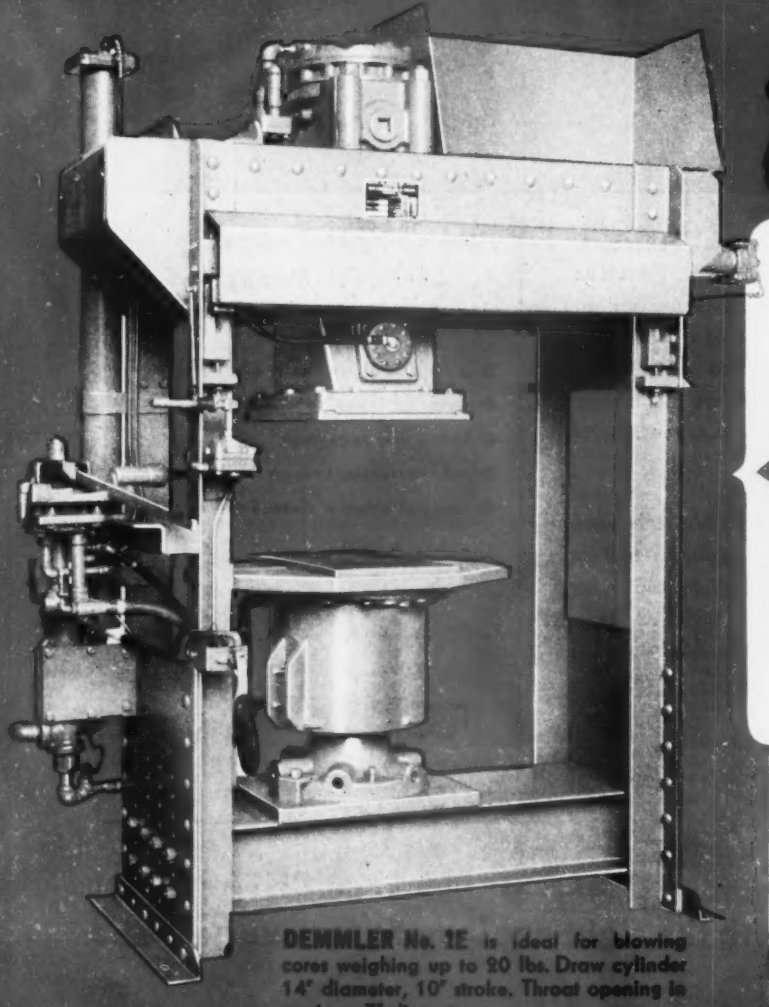
*U. S. Patent #2184926 (other patents pending)

Pangborn

BLAST CLEANS CHEAPER
with the right equipment for every job

32 DEMMLER CORE BLOWERS ie

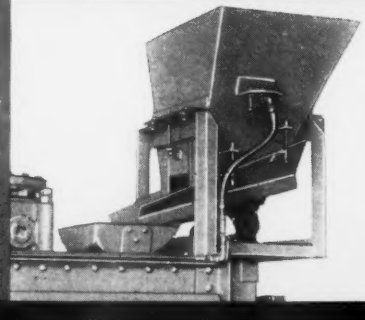




DEMMLER No. 1E is ideal for blowing cores weighing up to 20 lbs. Draw cylinder 14" diameter, 10" stroke. Throat opening in carriage 7" diameter.

Better 8 Ways

1. Ultra high speed blow valve action — increasing initial blow pressure 25% above other machines.
2. Magazine exhaust valve — extra large size — quick acting — immediately exhausts air from magazine after core is blown.
3. Carriage rails — on outside of machine frame — out of sand area — where drawing accuracy would be impaired.
4. Leveling adjustment — 4 screw adjustment for complete adjustment of core box to draw — EASILY ACCESSIBLE.
5. Completely enclosed drawing post — drawing accuracy within thousandths — protected from sand and abrasion — assuring long, trouble-free life.
6. 2 speed hydraulic draw control — low speed while vibrator is acting and quick drop after core is drawn.
7. Hard, chrome plated valve seats — insure against rust and deterioration.
8. All parts of machine easily accessible for low maintenance costs.



DEMMLER Vibratory Sand Feeders increase core blower production as much as 25%! Sand stored in large hopper flows like water while vibrators are operating. Powered by rotary type pneumatic vibrators. Ends poking sand nuisance!

DEMMLE
economic
One han
horizontal
weighing

Help speed *Studebaker* production

The efficient manner in which Studebaker doubled capacity of their foundry is a well known story to the trade today.

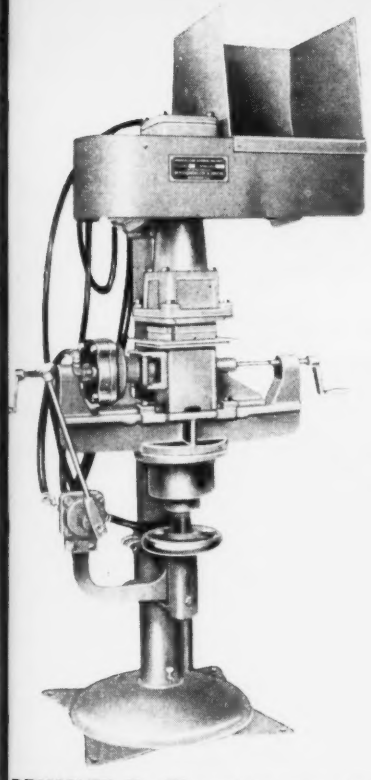
It pays tribute to the alert minds and capable hands for which the South Bend plant has long been known.

We at DEMMLER are gratified that these progressive Studebaker people have come to depend to a large extent on DEMMLER core blowers for their enviable record of fast, economical production of quality cores.

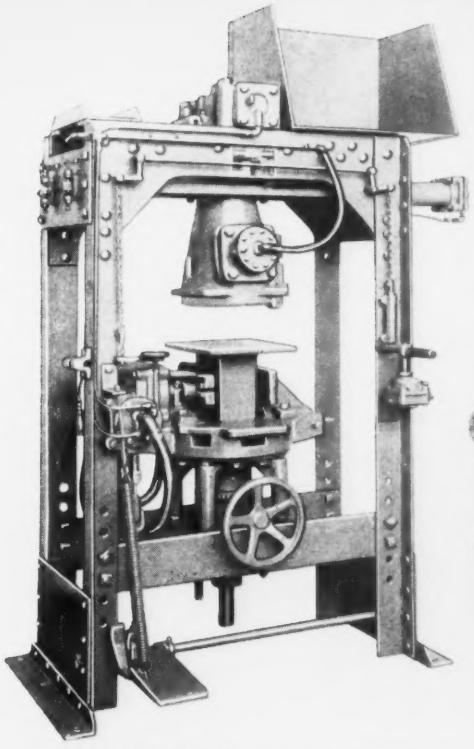
Thirty two DEMMLER core blowers are now in service at Studebaker!

Foundries everywhere have found that DEMMLER core blowers, because of their many outstanding features, are the wisest core blower investment on the market today!

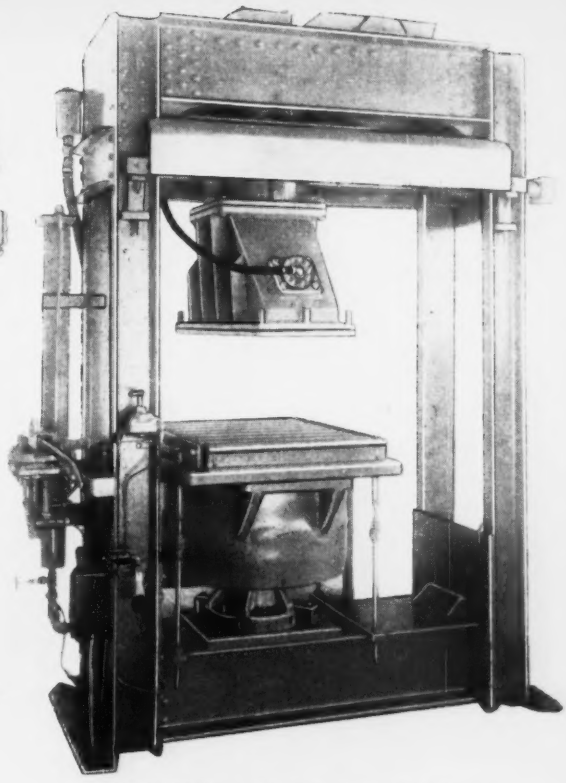
That's because DEMMLER core blowers—and only DEMMLER Core Blowers — offer you all eight of the important design features by which core blower value is determined.



DEMMLER No. 55 provides answer to fast, economical production on short run jobs! One hand valve operates both vertical and horizontal core box clamps. Capacity, cores weighing up to 5 lbs.



DEMMLER No. 1 is general purpose machine. Vertical clamping diaphragm, 10½" diameter. Capacity, 8 to 10 pound cores. One of the most popular core blowers ever built.



DEMMLER No. 4E handles cores weighing from 35 to 250 lbs. and up in weight. Draw cylinder 20", 22" or 26" diameter, 10" stroke. Throat opening in carriage 13" diameter.

Wm. DEMMLER & BROS., Kewanee, Illinois

MANUFACTURERS OF CORE BLOWERS EXCLUSIVELY SINCE 1911

301A
DURALITE GOGGLE
(For Wear Directly Over the Eyes)

Duralite Goggles

If Workers Chip, Grind, Drive or Cut Rivets or Rails ...Do Babbiting, Hand Tool or Machine Work

SELECT ONE OF THESE GOGGLES TO PROTECT THEIR EYES!

These popular, practical, "bread and butter" goggles are light in weight for comfort and strongly made for long life and the utmost protection against flying particles striking from any direction.

The "301A" has individual eyecups, molded to fit eye contours, and has smooth, rounded edges. They won't conduct heat or electricity and afford wide vision. Air channels in the eyecups and many perforations invite a natural draft behind lenses and reduce fogging. Ball-chain bridge adjusts easily and is insulated with curved tubing for comfortable fit.

The "321A" features opaque eyecups specially made to fit over practically all types of personal glasses. Ventilation and anti-fog properties are similar to the "301A." Bridge is of high grade leather and easily adjusted.

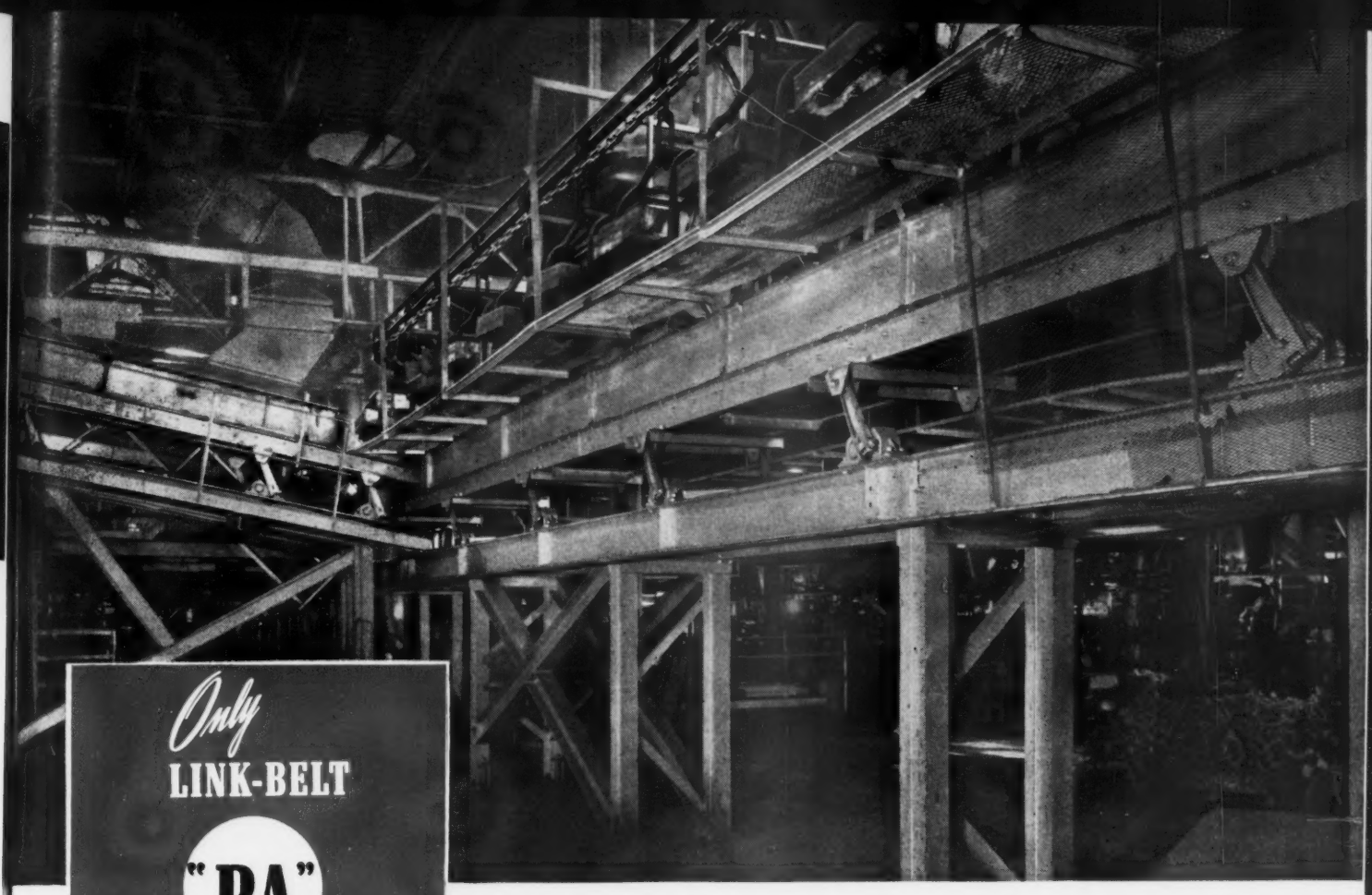
321A
DURALITE COVERGLAS GOGGLE
(For Wear Over Personal Glasses)

QUICK FACTS
(Both Goggles)

- Retaining rims are aluminum, specially treated to resist corrosion.
- Lenses are either 50 mm. Regular Super Armorplate or 6 Curve Super Armorplate as desired. Clear or Calobar in medium, dark or extra dark shades.
- Headband is one-piece rubber, easily adjustable.
- Available with rubber cushions around edges of eyecups at slight extra cost.

American Optical COMPANY
SAFETY PRODUCTS DIVISION

SOUTHBRIDGE, MASSACHUSETTS • BRANCHES IN PRINCIPAL CITIES



Only
LINK-BELT
"PA"
Oscillating Conveyor

In modernized midwestern foundry, two "PA" Oscillators handle hot castings. Coming in from the left, 50 ft. transfer conveyor feeds 75 ft. cooling and sprueing conveyor. Link-Belt Overhead Trolley Conveyor (above) delivers molds to shakeout.

...gives you these 9 conveying advantages!

FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION INC. MEMBER FEMA

(1) "PA" POSITIVE ACTION — Motion is imparted to the conveyor trough by a roller-bearing, constant-stroke eccentric, driven at selected speed. Uniform, continuous flow is assured regardless of overloads or surges.

(2) LEAK-PROOF — Standard trough is a single piece of metal with high sides—eliminates leakage and spillage.

(3) DUST-TIGHT — Escape of dust or gases can easily be eliminated by addition of a metal cover with flexible connections at loading and discharge points.

(4) COMPACT — A "natural" medium for passing congested locations—opening need be only slightly larger than the trough. Many are installed in small trenches to receive material from apparatus above.

(5) LONG LIFE — All-metal, with a minimum of moving parts, no joints to abrade. Handles very hot, sharp, jagged or oily materials with virtually no wear.

(6) MINIMUM MAINTENANCE — Only the drive need be lubricated. Steel torsion bars that provide the spring action last indefinitely without attention.

(7) VERSATILE — Widths from 8 to 54 in., lengths up to 100 ft. Efficiently handle from a few pounds to 200 tons per hour. Dividers can be installed to convey more than one material simultaneously, and discharge is possible at any desired points.

(8) GENTLE — No breakage of thin or brittle castings. Even a cigarette ash can travel the entire length of the trough intact.

(9) ECONOMICAL — Particularly on longer runs, first cost is low. Installation and alignment are simple, fast.

Yes, on any count, Link-Belt "PA" Oscillators are years ahead. These revolutionary conveyors have proved themselves efficient for handling coolant-soaked steel turnings, foundry shakeout sand and castings, and other sharp, abrasive, hot materials. Ask for Book 2444 containing complete information.

LINK-BELT

CONVEYORS and PREPARATION MACHINERY

LINK-BELT COMPANY: Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Houston 1, Minneapolis, 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8, Springs (South Africa). Offices in Principal Cities.

12,358

12 years of maintenance free operation with BS&B FOUNDRY FLASKS

BLUE VALLEY FOUNDRY COMPANY

BS&B Foundry Flasks being put through their regular paces at the Blue Valley Foundry Company: here they're working yokes and diaphragms . . . a part of their valve casting set-up, requiring precision.

The Blue Valley Foundry Company is one of Kansas City's older industries. Twelve years ago they began replacing worn equipment with BS&B Foundry Flasks.

President J. T. Westwood says they have required no maintenance on BS&B Flasks in that time. Blue Valley has recently taken over the Harrisonville Foundry, Inc. at Harrisonville, Missouri. Here, too, BS&B Foundry Flasks are used exclusively. These are jobbing foundries casting grey iron and semi-steel. Their list of customers include some of the mid-west's largest industrial leaders. Continual abuse under actual use have convinced Blue Valley, as is the case with so many foundries, that BS&B Foundry Flasks are built to take it . . . thus cutting down maintenance . . . making it a less expensive flask in the long run.

BS&B FOUNDRY FLASK HANDBOOK

Includes the easy to order system

Your free copy will be sent you promptly—just write. It's a handy catalog and useful foundryman's "bible" . . . contains complete diagrams, specifications, tables and all pertinent information on BS&B Foundry Flasks.

BS&B Heavy Duty Flasks Are Built To Take It Too!

Any BS&B Foundry Flask can be tailor made to your requirements. Our Heavy Duty Foundry Flasks are just that . . . they're built to take the heavier loads—greater abuse. Only BS&B gives you all three of these features in a heavy duty flask—

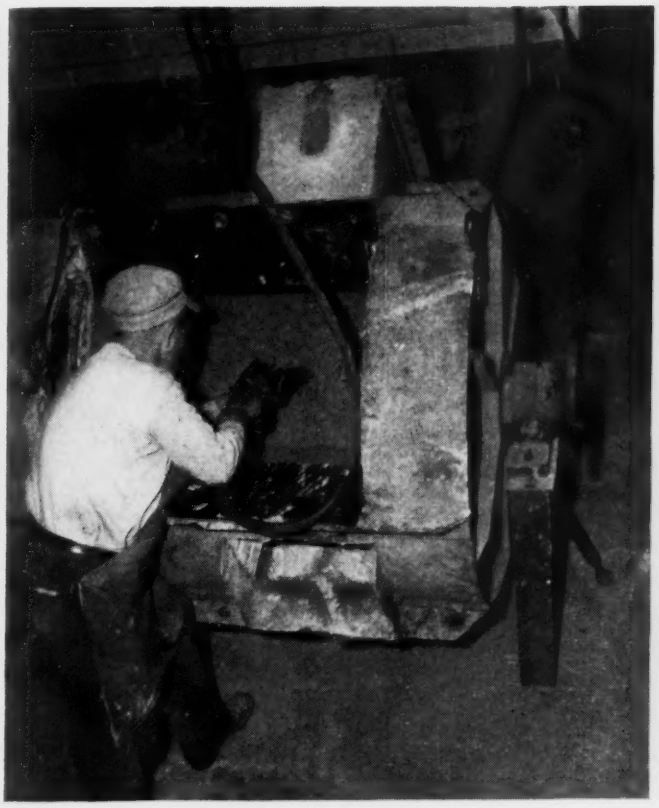
1. **Welding of bearing strips, both inside and out.**
2. **Cast steel trunnions.**
3. **Cast steel pin lugs and clamp lugs.**

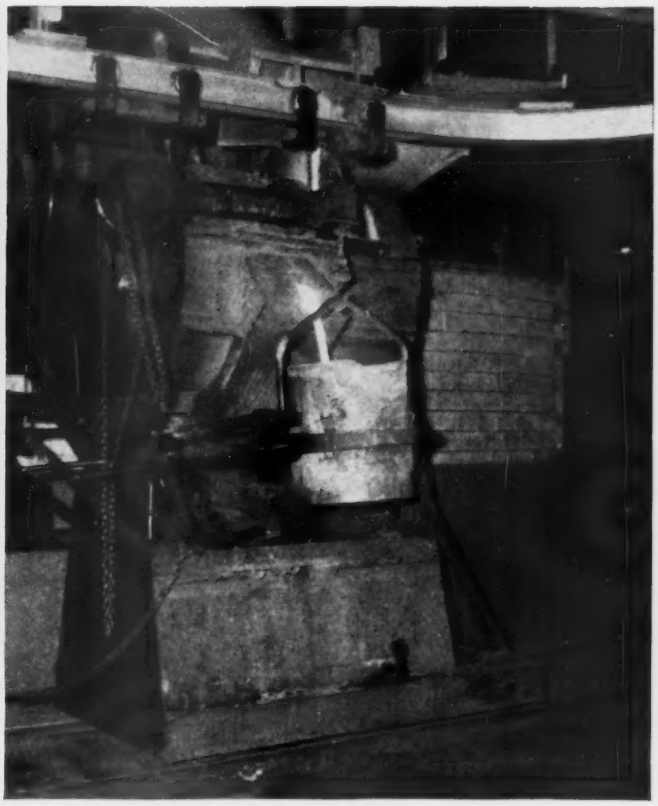
FOUNDRY BS&B FLASKS

BLACK, SIVALLS & BRYSON, INC.

7500 EAST 12TH STREET KANSAS CITY 3, MISSOURI

Foundry Flask Division, Dept. 7-AR6





Left: **DESULPHURIZING LADLE** for handling gray iron being lined with a special Norton ALUNDUM* refractory cement.
Right: In operation, ALUNDUM cement lining lasts 2 to 4 times longer than other linings.

Desulphurizing ladle linings last up to 4 times longer

... *with Norton ALUNDUM cement*

How long do your present ladle linings stand the violent boiling action that results when you add sodium carbonate briquettes to desulphurize your gray iron?

Not long enough? Change to a special Norton ALUNDUM refractory cement and see what happens.

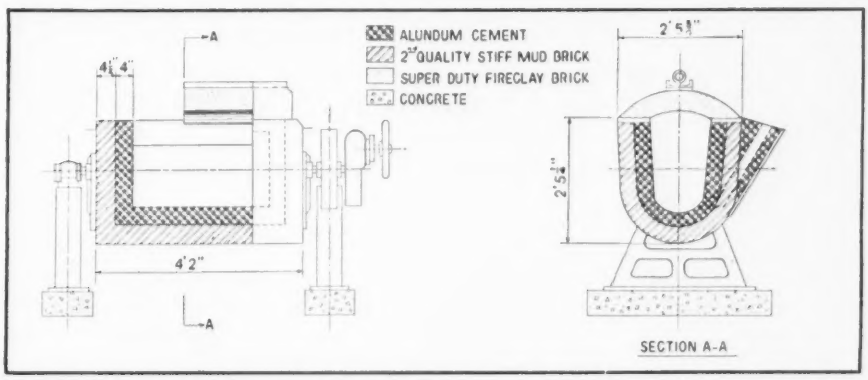
Test Shows Amazing Results

In one case, a foundry which operates a 1500 lb. capacity Whiting "U" shaped ladle for desulphurizing gray iron decided to test ALUNDUM cement. Lining life was increased 200-400%.

This foundry has now standardized on Norton ALUNDUM cement . . . and gets extra dividends in the form of easier installation, lower maintenance cost, lower over-all refractory cost.

Run a Test Yourself

Yes, why don't you test Norton ALUNDUM cement in your ladles, too? In the meanwhile, get further information from your nearby Norton representative — or write direct to NORTON COMPANY, Refractories Division, 303 New Bond Street, Worcester 6, Mass. *Canadian Representative:* A. P. Green Fire Brick Co., Ltd., Toronto, Ontario.



NORTON ALUNDUM CEMENT, in the test mentioned, was air-hammered 4" thick over 4½" of second quality stiff mud brick in the ladle and the entire spout. This was air dried overnight . . . and heated gently with a low-flame gas torch until thoroughly dried. Finally, the ladle was brought up to full heat and put into service.

*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

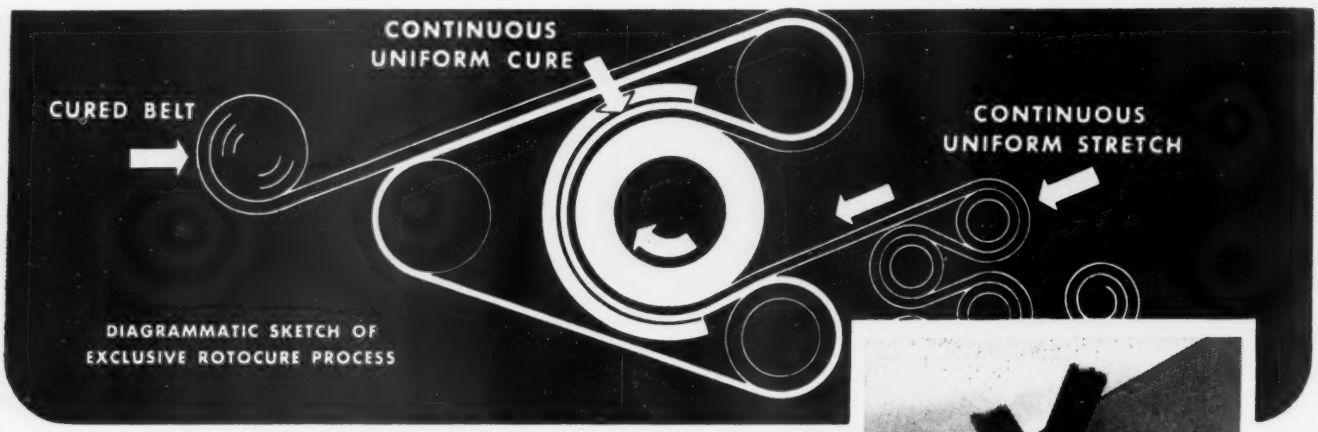
NORTON

Special REFRACTORIES

Making better products to make other products better

NORTON COMPANY, WORCESTER 6, MASSACHUSETTS

For Continuous Operation



Buy a Belt that's Continuously-made

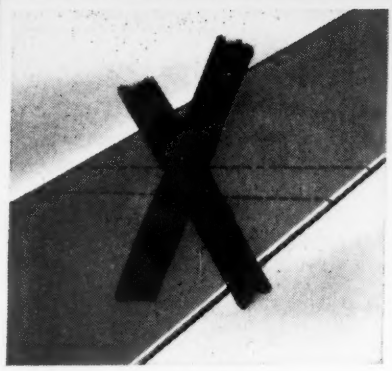
(Rotocured BWH Conveyor Belts have no OCS*)

Belts made by the conventional flat press method of "start and stop" curing tend to fail early because segments are *overcured.* Here's how it happens: A section is cured. STOP. Another section is cured. STOP. Part of the first section is cured *a second time* because the belt is advanced less than a full press length. This part of the belt becomes a weakened structure about 2" to 4" wide. These press overlaps occur *every 30' to 40'!*

The "cure" for this problem is *avoid overcuring* — and that's exactly what Rotocure avoids with its *continuous* endless technique of curing. BWH Rotocured belts thereby give users the following *specific* advantages:

1. **Increased belt flex life (up to 40%).**
2. **Elimination of mechanical distortion at the press ends.**
3. **Constant, uniform stretch.**
4. **Uniform, abrasion-resistant covers.**

Your BWH distributor knows belts and can give you real help on your conveyor problems. Ask him for the full dollars and cents story on ROTOCURE and you'll see how your per ton costs can drop in materials conveyed. Check with him on BWH Transmission Belts too — there's another cost-saving story through operation at lower tensions.



***Overcured Sections — present every 30' to 40' in all belts made by flat press method.**

BWH
DEPENDABLE RUGGEDNESS

Another Quality Product of

BOSTON WOVEN HOSE & RUBBER COMPANY

Warehouse Stock: 111 N. Canal St., Chicago, Illinois **Distributors in all Principal Cities**

PLANT: CAMBRIDGE, MASS. • P. O. BOX 1071, BOSTON 3, MASS., U. S. A.

PAYLOADERS Can Help You Too

FOUNDRIES and metal-working plants in increasing numbers are installing Hough PAYLOADERS because they are a sure, proven way to lick rising costs, solve manpower shortages and increase output.

A PAYLOADER more than pays its way every day — actually pays for itself within a few months doing the many jobs listed here and doing them faster and cheaper . . . releasing manpower for more productive work.

The 12 cubic foot Model HA shown is the smallest of the PAYLOADER line that includes graduated sizes up to 1½ cubic yard bucket capacity. Every PAYLOADER is a complete, Hough-built tractor-shovel specifically designed with multiple reverse speeds and other features that insure fast, low-cost bulk material handling. They are backed by 30 years of material-handling equipment manufacture and are sold and serviced by a world-wide Distributor organization. The Frank G. Hough Co., 703 Sunnyside Ave., Libertyville, Ill.

Literature on any size PAYLOADER will gladly be sent without obligation.

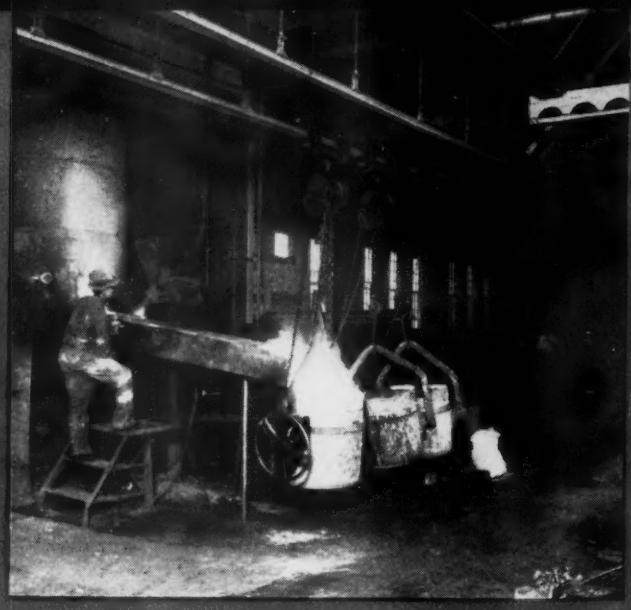
On These Jobs

Unload box cars.
Carry sand, coke, scrap, limestone, etc., to storage.
Transport and distribute sand to molding stations.
Remove used sand from floors.
Windrow sand for the cutter.
Charge mullers, hoppers, tumbling barrels.
Feed conveyors, elevators, mixers, screenerators.
Clean up gangways, aisles and other areas.
Handle coal, ashes, cinders.
Handle scrap and small castings.
Maintain private roadways.
Do crane work—haul, push.
Remove snow.

SAY "HUFF"

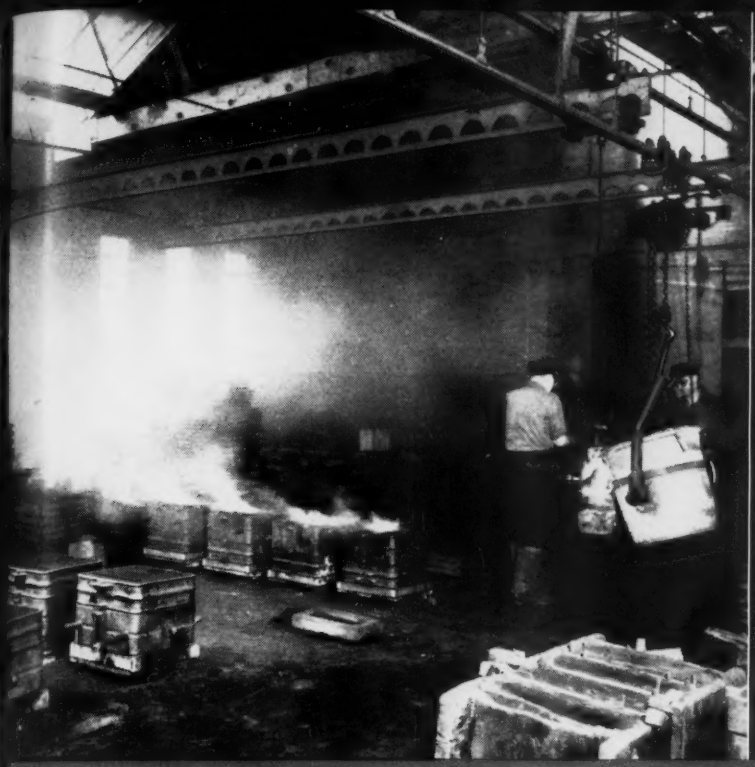
PAYLOADER®

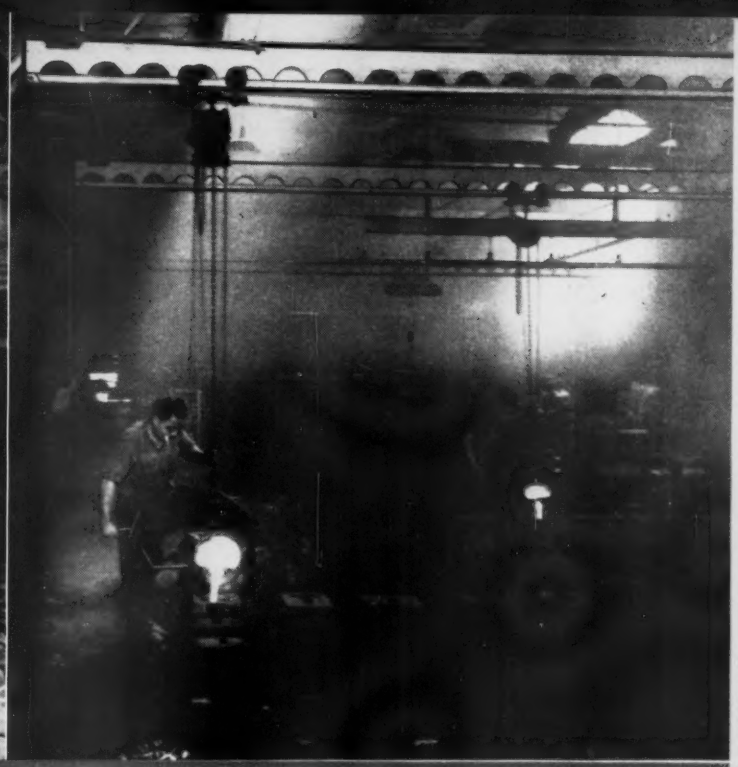
THE FRANK G. HOUGH CO. • Since 1920



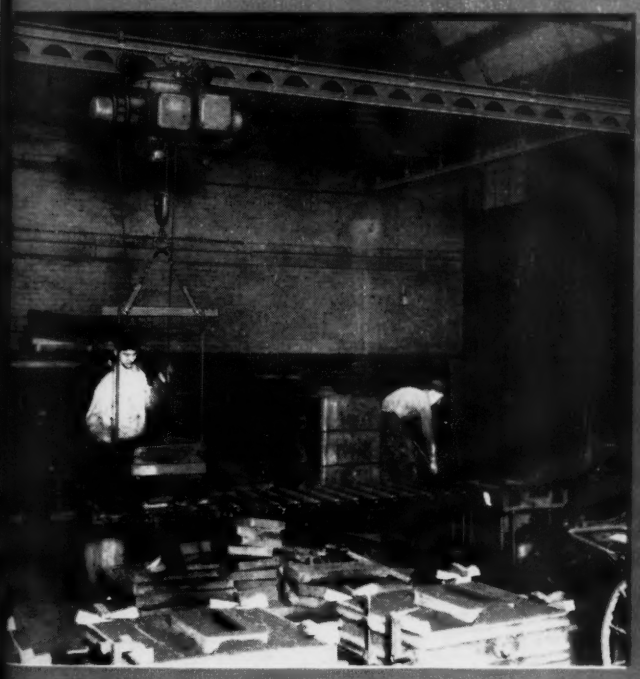
...PRODUCTION

A VITAL WORD SYNONYMOUS WITH CLEVELAND TRAMRAIL





CLEVELAND TRAMRAIL SPEEDS FOUNDRY PRODUCTION



Today one of the most vital words in the dictionary is PRODUCTION. Every device conceivable is being considered or adopted that will aid the output of a plant. This holds true in foundries. Castings of every kind are needed badly.

When one considers that from 150 to 250 tons of materials (such as sand, flasks, molds, cores, pig iron, scrap, molten iron, rough castings) are handled to produce one ton of finished castings, the importance of the labor and time required for handling is more fully appreciated. Indeed, one of the most important ways of stepping up production in a foundry is through use of equipment that will facilitate handling.

In hundreds of foundries Cleveland Tramrail has eliminated a vast amount of unnecessary rehandling and greatly reduced manual drudgery. Because of this modern overhead materials handling equipment many more tons of castings are being produced with the same facilities and labor.

GET THIS BOOK!

BOOKLET No. 2008. Packed with valuable information. Profusely illustrated. Write for free copy.

CLEVELAND TRAMRAIL DIVISION
THE CLEVELAND CRANE & ENGINEERING CO.
3817 EAST 286th ST. *WICKLIFFE, OHIO.*

CLEVELAND TRAMRAIL

OVERHEAD MATERIALS HANDLING EQUIPMENT

Control Foundry Chilling with...

CHILL KOOLHEAD NAILS

CHILL NAILS and SPIDERS in many types and sizes

Choose any style chill nail from jumbo to stubby; slim, medium, or horse nail blade; blunt, pointed, straight or 90° bent. Same types available in Stainless, Brass, Aluminum; Copper coated to order. Spider Chills, jumbo or horse nail legs—double or single. Available in various sizes and types; also made to your individual specifications. Whatever your chill job, rely on "KOOLHEAD."

Equally reliable—the "STANHO" precision quality line of Taper Pins, Woodruff Keys, Machine Keys, Cotter Pins, Straight Pins, Knurled Pins and all sorts of finished specialties and made-to-order parts.

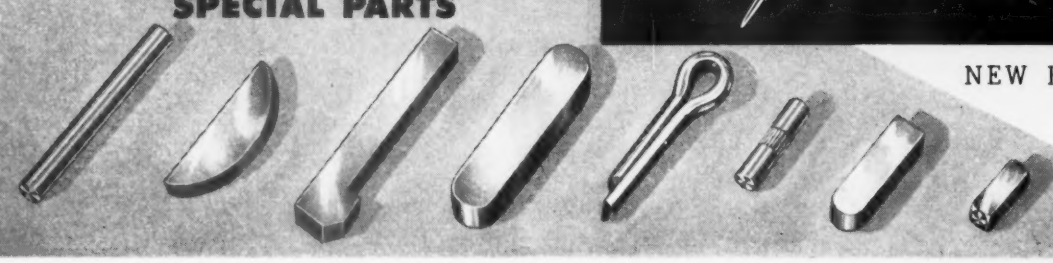
Write for detailed descriptions and prices.

Other Quality Products

STEEL Stanho PRODUCTS

PINS KEYS

SPECIAL PARTS



STANDARD HORSE NAIL CORP.

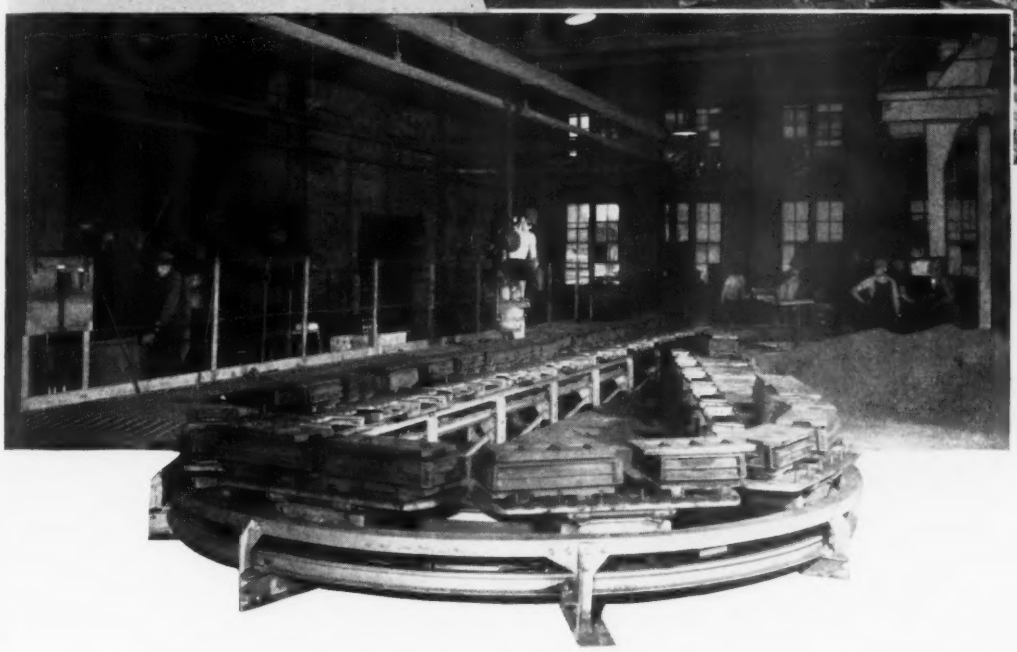
Since 1872

NEW BRIGHTON, PA.

F-4

NO MODERNIZATION WITHOUT MECHANIZATION

So Call In a JEFFREY ENGINEER



These two photos depict a Jeffrey-equipped Foundry. It is completely modernized to provide the ultimate in plant efficiency. Our Foundry Engineers are generous in their desire to help you modernize your operations.

Aerators
Bucket Elevators
Chains
Clamshell Valves
Cleanarators
Crushers

Casting Conveyors
Disintegrators
Feeders
Flask Fillers
Apron Conveyors

Paddle Mixers
Power Scoops
Mold Conveyors
Screens
Sanditioners

There must be a heap of satisfaction in having a completely-modernized Foundry . . . a smooth-running and harmonious system. Jeffrey has the equipment . . . the engineers to help you do just that . . . provide performance that enthuses the owner and the foundry superintendent alike. Give us a chance to go to work for you.

THE JEFFREY MANUFACTURING COMPANY
907 North Fourth St., Columbus 16, Ohio

1877 75 YEARS 1952

Baltimore 2 Boston 16 Cincinnati 2 Detroit 13 Houston 2 New York 7 St. Louis 1
Beckley, W. Va. Buffalo 2 Cleveland 15 Forty Fort, Pa. Jacksonville 2 Philadelphia 3 Salt Lake City 1
Birmingham 3 Chicago 1 Denver 2 Marion, Ky. Milwaukee 2 Pittsburgh 22

Jeffrey Mfg. Co. Ltd., Montreal, Canada
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Jeffrey-Galion (Pty.) Ltd., Johannesburg, S. A.
The Galion Iron Works & Mfg. Co., Galion and Bucyrus, Ohio
Galion (Great Britain Ltd.), Wakefield, England
The Ohio Malleable Iron Co., Columbus, Ohio
The Kilbourne & Jacobs Mfg. Co., Columbus, Ohio

Republic Air Hose makes these rivet guns talk

● And it's a loud voice, too, as nearly 300 rivet guns bark out the signals that mean new railway cars in the making!

The partially fabricated cars simultaneously roll down several production lines, halting only momentarily for the embrace of husky cross hammers that sew up the metal seams with a steady, sure power beat delivered through Republic Air Hose.

As you can see, it's no easy life for a hose!

The floor's concrete and littered with sharp scraps of metal. The constantly flexing hose lies at the workman's feet. Sometimes he stands on it; sometimes he gives it a healthy kick as he jockeys for position over a line of rivets.

But despite the kicks and cuts and bruises and the high pulsating pressures, expected on jobs like these, Republic's Air Hose continues to deliver.

It's so good, in fact, that this particular manufacturer has been using Republic Air Hose since 1929. The hose is bought in long reels and, as required, lengths are cut for use on the giant forming presses, riveters, paint guns, dryers . . . in fact, Republic Air Hose is used on every bit of air-operated equipment in this plant.

And naturally, it's all purchased from a local Republic Distributor, who's always available for immediate deliveries or on-the-spot advice regarding proper selection and care of all types of Industrial Rubber Products.

There's a Republic Distributor near your plant who can give you similar service. Get to know him now!

Simply drop us a card and we'll have him call at your convenience.

Remember, Republic has been **the** specialist in the field for 52 years and—**if it's made of rubber, Republic builds it better!!**

INDUSTRIAL RUBBER PRODUCTS BY

REPUBLIC RUBBER DIVISION

Lee Rubber & Tire Corporation

YOUNGSTOWN, OHIO

4 STEPS that lead to better cores

1. ASK THE HOUGHTON MAN

. . . when he calls on you he's there to give you on-the-job service. Ready to talk over your core-making problems. Anxious to help in any way he can with sound, practical solutions. He knows *good service* is the first step in selling good products.

2. GET HELP FROM HOUGHTON RESEARCH

. . . because our continuing core oil research program was established years ago to help foundrymen as much as our own technicians. It's convinced us — for one thing — that it takes the right *sand and oil combination* to make cores that produce sound castings economically. One way we'll help is by testing for the proper match of core oil to sand.

3. STANDARDIZE ON THE *RIGHT* CORE OIL

. . . *one* type of Hy-Ten Core Oil, properly chosen, will assure a fast and accurate bake on a wide variety of cores — even under varying conditions. Your operating costs can be substantially lower if you use the proper Hy-Ten Core Oil . . . and we'll help you make sure it *is*.

4. GET THE ADVANTAGE OF HOUGHTON'S EXPERIENCE

. . . because our service to you doesn't end with the order! Houghton's foundry-minded staff — backed by three generations of accumulated "know-how" — can check your core-room procedure to make sure of continuing efficiency. Why not look into the benefits of standardizing on Hy-Ten right now?

HERE'S HOW FOUNDRYMEN GET HIGHER EFFICIENCY BY DEPENDING ON HOUGHTON'S 85 YEARS OF EXPERIENCE AND MANUFACTURING "KNOW-HOW."

Hy-Ten Core Oils

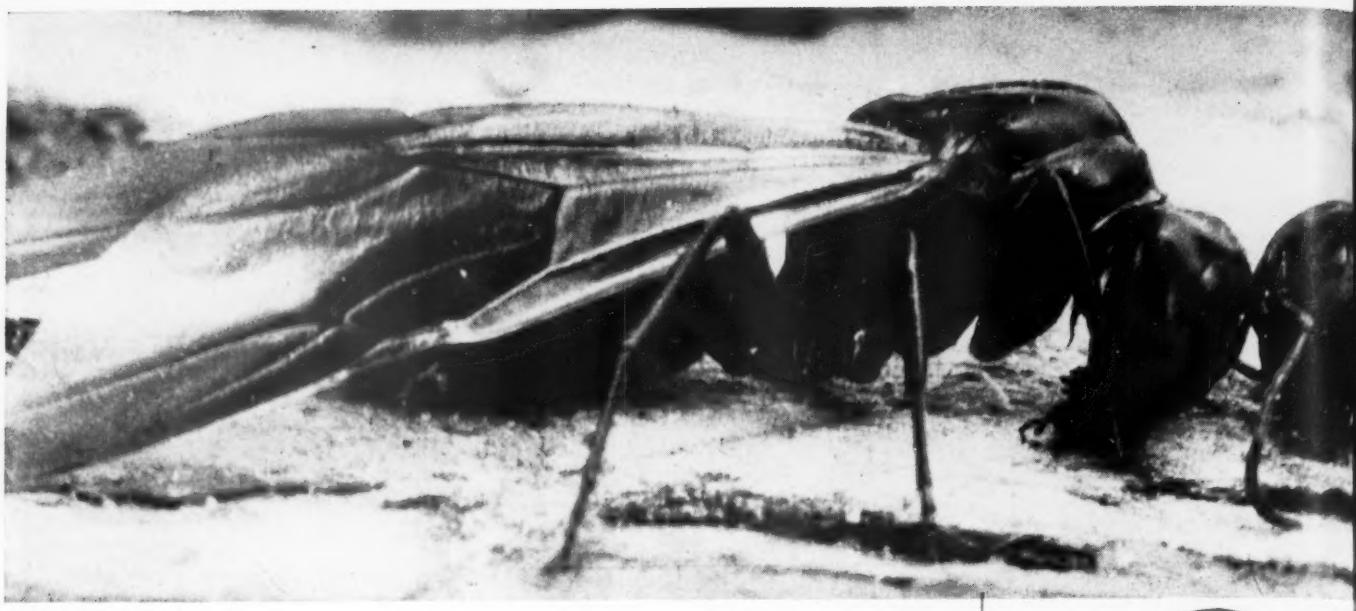
. . . products of

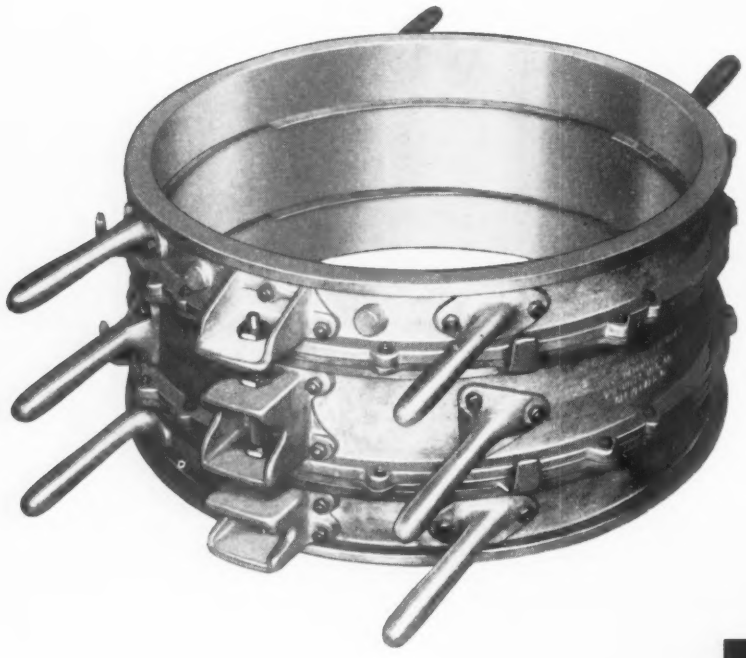
E. F. HOUGHTON & CO.

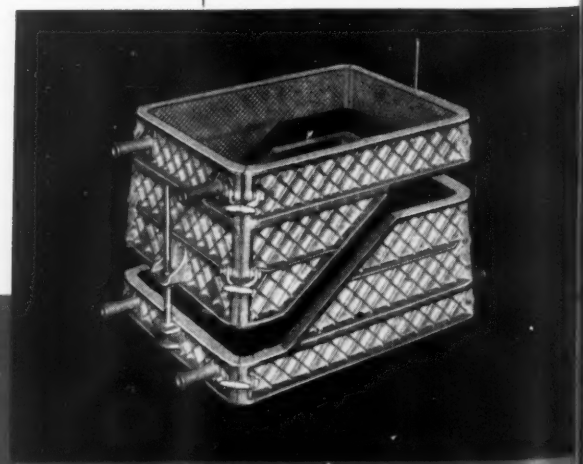
PHILADELPHIA · CHICAGO · DETROIT · SAN FRANCISCO

Ready to give you on-the-job service . . .

Write to E. F. Houghton & Co., Philadelphia 33, Pa., if you want latest Hy-Ten Bulletin.







There are at least 6,000 species of ants, world-wide in distribution. Some types have developed specialized agricultural habits—sowing seeds and reaping harvests. Others capture aphids, or green flies, and transport them to their nests, where they are tended and milked like cattle. There are colonies with slaves belonging to another species, which are trained to gather food, serve as nurses or as protection for the foraging parties. Ants have their own way of communicating with each other. In the photo-enlargement, a queen ant and a carpenter ant are conversing.

iciency

The ant is one of nature's most extraordinary creatures. It possesses intelligence unmatched in the insect world and performs a wide variety of social and industrial chores with an *efficiency* that is absolutely amazing.

HINES FLASKS, too, perform with an unusually high degree of efficiency. Whether you use HINES "Pop-Off" flasks or HINES round, slip or tight flasks, you are assured of top performance because each is built to meet the most severe foundry conditions. HINES also designs and builds special flasks, incorporating the "Pop-Off" feature if desired and practical, for odd-shaped castings or difficult jobs.

Yes, you can always count on an extremely efficient performance from HINES FLASKS. Why not give them serious consideration when you're in need of standard or special flasks?

HINES POP-OFF FLASK

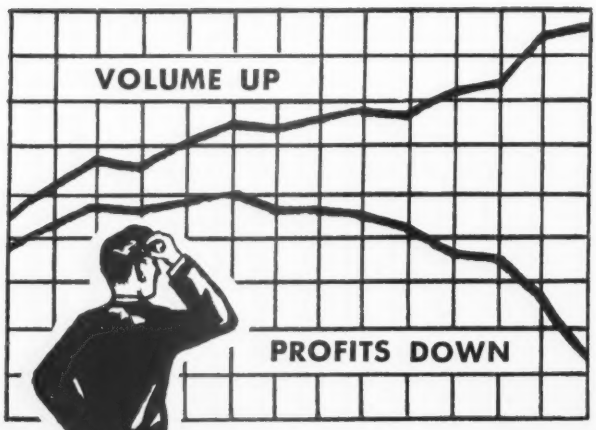
HINES FLASKS

THE HINES FLASK CO., 3431 WEST 140TH STREET

CLEVELAND 11, OHIO • TELEPHONE: ORCHARD 1-2806

AJAX

Lo-Veyors



HERE IS ONE OF YOUR FEW REMAINING WAYS TO PARE DOWN RISING COSTS

● Materials handling by old-fashioned, man handling methods is an easily overlooked, but expensive item in your non-productive labor column. This is increasingly true under present day operating conditions. Manufacturers are taking advantage of Ajax Lo-Veyors as a source of important economies in handling bulk materials.

Ajax Lo-Veyors provide fast, automatic, trouble-free handling of bulk materials in and outdoors, under abrasive, corrosive, poisonous and explosive laden air.

Write for facts on the advantages of Ajax Vibrating Conveyors.

AJAX FLEXIBLE COUPLING CO. INC.
WESTFIELD, NEW YORK

for **1.** Assured Core Support **2.** Maximum Fusion **3.** Freedom From Leakers **4.** Accurate Wall Thicknesses **use**

The ALL-NEW GROOVESTEM

FEATHEREDGE FUSION RINGS

Knife-like multiple Rings heat instantaneously to fusion temperatures—burning in and eliminating leakers.

COMPLETE CONTACT RADIUS GROOVES

Molten metal lays up solidly against the rounded bases of the radius grooves. Greater chaplet area contact results in maximum fusion. No sharp threads to trap gases or weaken stem strength.

COUNTERSUNK SHOULDERS

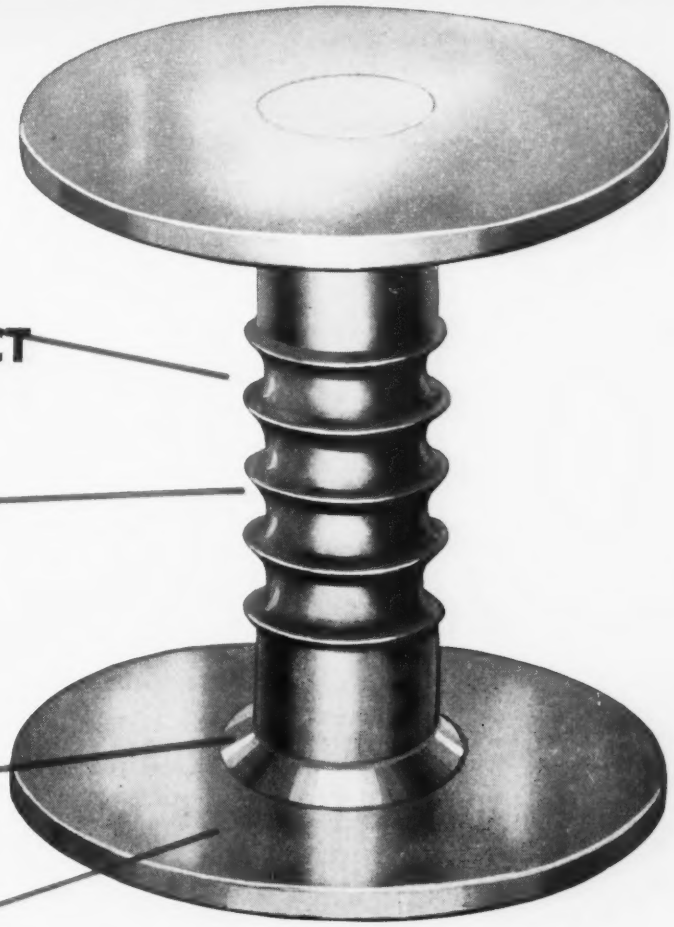
Heavy tapered shoulders provide solid support to plates—allow full contact with molten metal. No sharp angles to create voids usually formed under heads of ordinary chaplets.

TIN OR COPPER COATED

Either is a sure protection against rust, and actually aids fusion. Each readily alloys with iron or steel lowering melting point, thus improving fusion.

PRECISION TOLERANCES

Held to plus or minus .002 on most sizes, Fanner reputation for accuracy is unequalled.

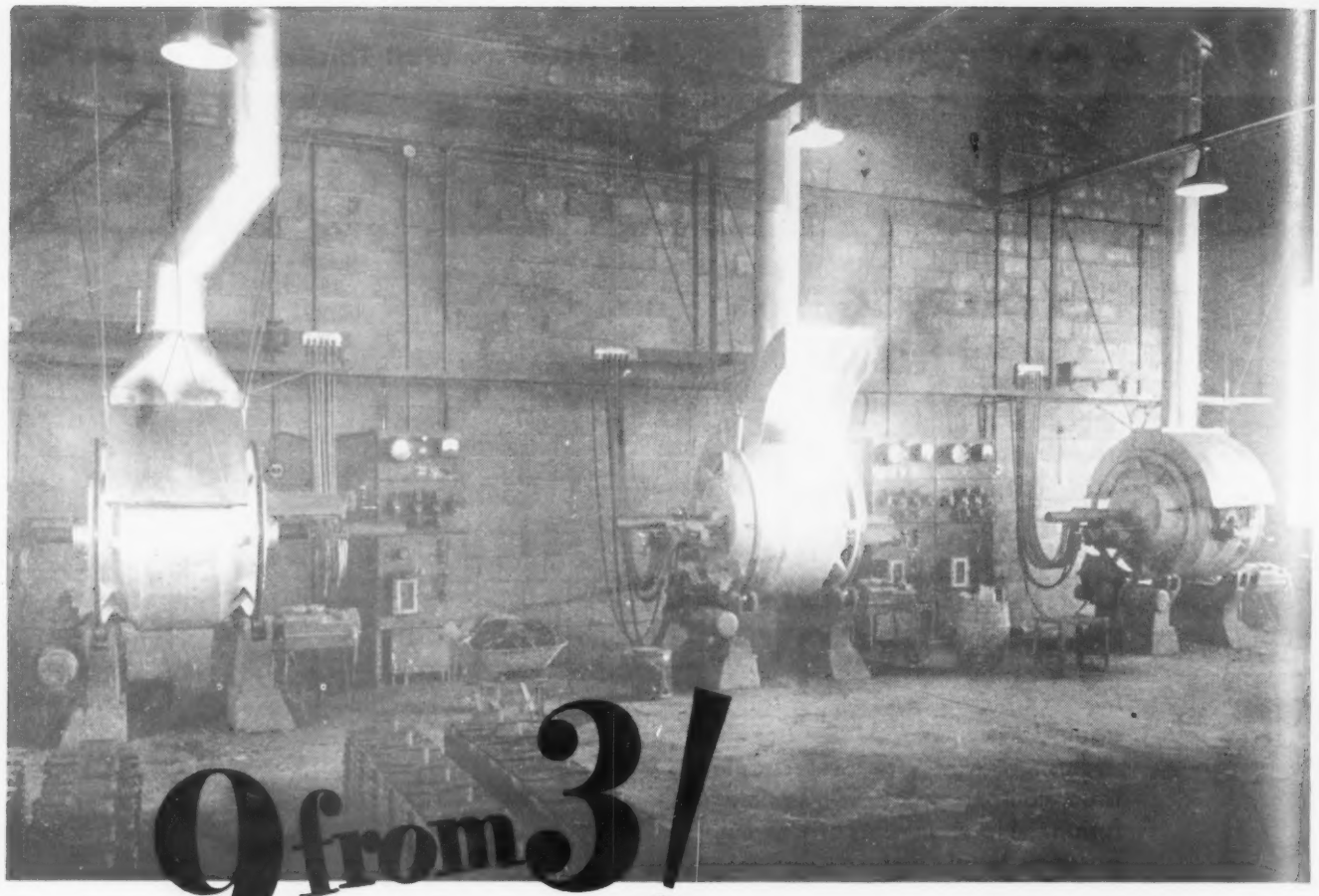


Patent Pending

For 58 Years Fanner Chaplets have been the standard of excellence in the foundry industry. In an effort to produce an even better chaplet, The Fanner Manufacturing Company commissioned the Battelle Memorial Institute, Columbus, Ohio, to conduct *exhaustive studies of chaplet design.* Based on these studies, supplemented by field tests in leading foundries, Fanner Manufacturing Company has developed the new Groovestem chaplet, further insuring the maximum in core support and completeness of fusion.

FANNER MFG. CO., CLEVELAND 9, OHIO

In Canada: CANADIAN FANNER, LTD., Hamilton, Ont., Canada



9 from 3!

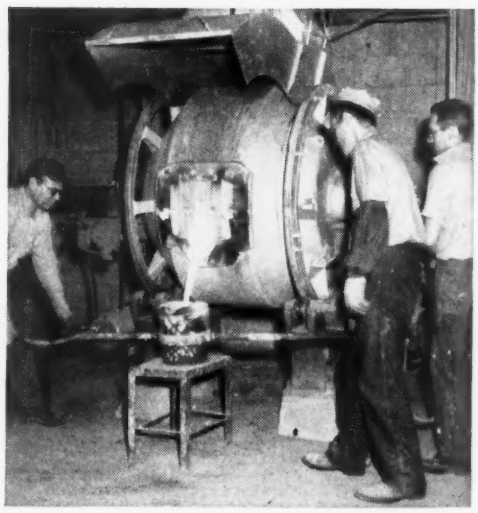
NINE TONS OF HIGH QUALITY IRON PER SHIFT FROM THESE 3 DETROIT ROCKING ELECTRIC FURNACES

Vassar Electroloy Products Company has based its growth on precisely controlled, quality iron and steel castings. In five years, metal melting requirements have increased more than 700%.

Today, three 700-lb. Detroit Rocking Electric Furnaces keep the pouring ladles full, producing alloys with exact metallurgical and physical characteristics melt after melt. The fast, efficient operation of these furnaces maintains high production levels and high standards of economy.

For melting ferrous or non-ferrous metals, these indirect arc furnaces have many advantages; easy, positive control; uniformity of melts; thorough mixture of elements through the melts; optimum use of power; less metal shrinkage; more heats per day; easy shell replacement.

Furnaces are available in 10 to 4,000 lbs. capacity, designed specifically to fit your electrical specifications. Get full information. Write today!

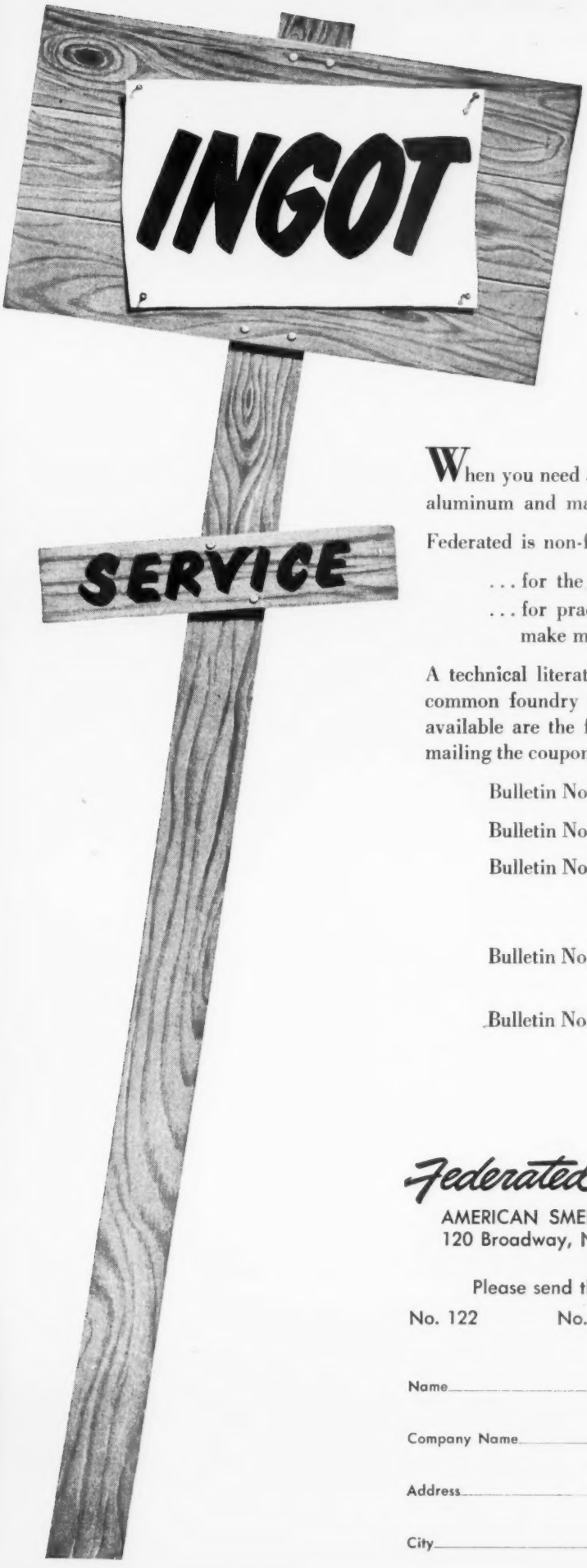


Tapping a heat of alloy steel from Detroit Rocking Electric Furnace at Vassar Electroloy Products Co. Furnace is Type LFY, 700 lb., 175 Kw.

DETROIT ELECTRIC FURNACE DIVISION

KUHLMAN ELECTRIC COMPANY, BAY CITY, MICHIGAN

Foreign Representatives: in BRAZIL—Equipamentos Industrias, "Eisa" Ltd., Sao Paulo; CHILE, ARGENTINA, PERU and VENEZUELA: M. Castellvi Inc., 150 Broadway, New York 7, N. Y.; MEXICO: Cia Proveedora de Industrias, Atenas 32-13, Apartado 27A3, Mexico 6, D. F., Mexico; EUROPE, ENGLAND: Birlec, Ltd., Birmingham.



When you need any non-ferrous ingot . . . brasses, bronzes and alloys of aluminum and magnesium . . . see Federated first.

Federated is non-ferrous metals headquarters

. . . for the widest variety of the best foundry products
. . . for practical and technical service that helps you make more profits.

A technical literature library from which you can obtain help to solve common foundry problems is a feature of Federated service. Currently available are the following easy-to-read articles. Order by filling in and mailing the coupon below.

Bulletin No. 122—Pyrometry in the Non-Ferrous Foundry

Bulletin No. 117—Melting Practice for Copper-Base Alloys

Bulletin No. 104—Effect of Room Temperature in Intervals between Quenching and Aging of Aluminum Sand Casting Alloys

Bulletin No. 123—Practical Steps for Reducing Porosity in Non-Ferrous Castings

Bulletin No. 126—Effect of Magnesium on Aluminum-Copper-Silicon Casting Alloys

Federated Metals Division

AMERICAN SMELTING AND REFINING COMPANY
120 Broadway, New York 5, N. Y.

Federated first in the non-ferrous field FMD

Please send the bulletins which are circled.

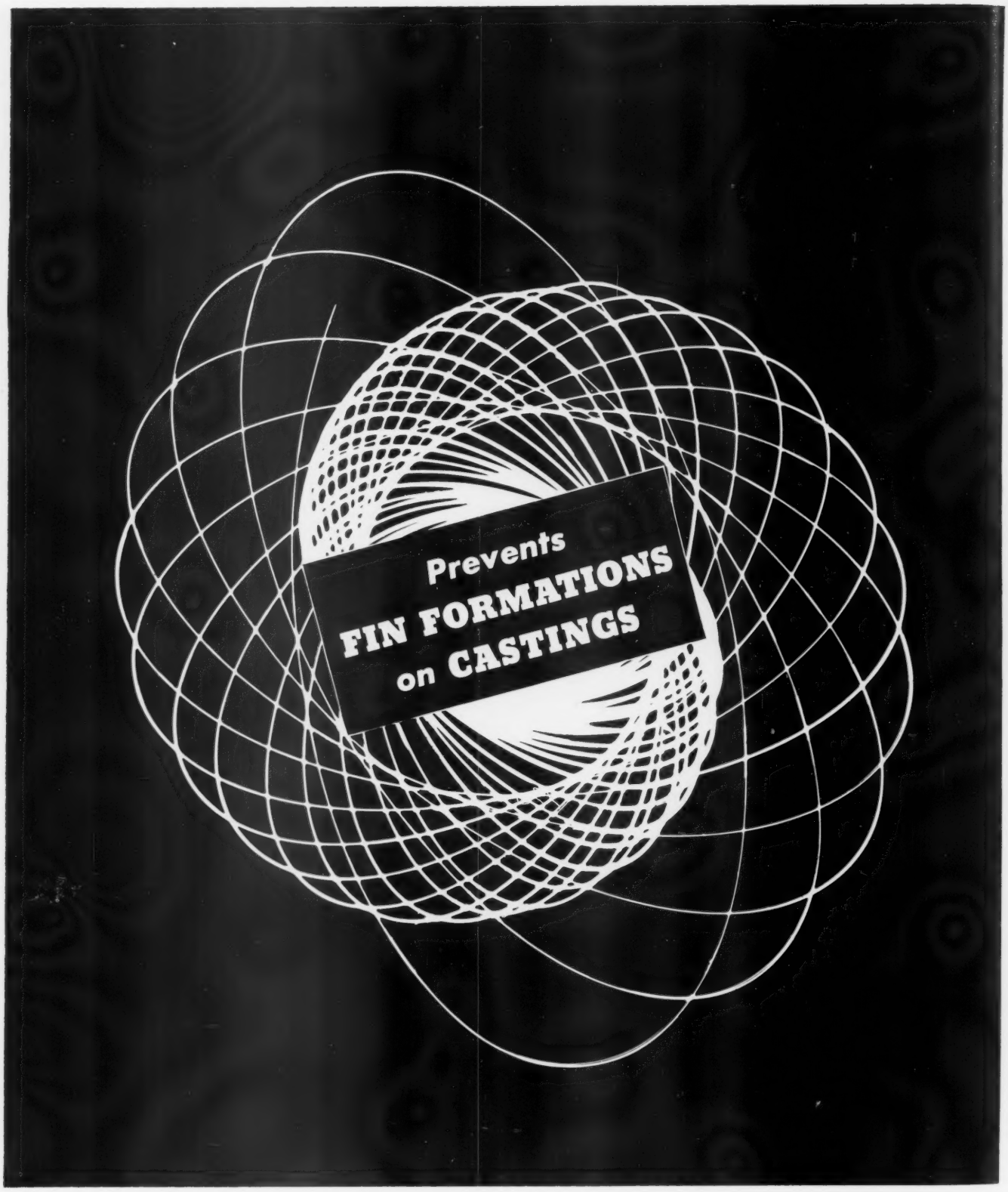
No. 122 No. 117 No. 104 No. 123 No. 126

Name_____ Title_____

Company Name_____

Address_____

City_____ Zone_____ State_____



THROUGH THE ELIMINATION OF CRACKED CORES, TAM ZIRCONITE Sand provides a feature of special interest to foundries making cores such as used on pump impellers. Why not get complete facts on the superiorities of ZIRCONITE. Merely, send your request to our New York Office.

*TAM and ZIRCONITE are registered trademarks.

TAM PRODUCTS
Registered U. S. Pat. Off.

TITANIUM ALLOY MFG. DIVISION
NATIONAL LEAD COMPANY
Executive and Sales Offices: 111 BROADWAY, NEW YORK CITY
General Offices, Works and Research Laboratories: NIAGARA FALLS, N. Y.

How Much EXTRA Are You Paying For Cores?

40 kw, 150,000 Btu *Foundromatic* dryer shown in high production foundry.

CHECK THE SAVINGS others are getting using the *Foundromatic* core dryer. It will pay you to find out what it can do for you in your foundry.

It's time you enjoy savings like these, too:

- Handling time cut 60-80%! Cores are placed directly on the moving conveyor belt of the dryer by the coremaker. In a few minutes they come out — cool enough to handle with bare hands — ready for the molder.
- Drying time cut 80%! Cores are dried in minutes instead of hours.
- Fuel cost cut 60%! All the heat goes into the core. In addition, unit can be shut off when not in use.
- Rejects reduced! Overbaking of cores and burning of fins and thin sections are eliminated.

If you investigated dielectric sand core drying a few years ago and decided that it wasn't ready, it's time you investigate again. Progress has been great. Seldom do you have the chance of enjoying such spectacular returns on your investment.

Call your nearby Allis-Chalmers district office for new booklet, or write Allis-Chalmers, Milwaukee 1, Wis.

A-3725

Foundromatic is an Allis-Chalmers trademark.

ALLIS-CHALMERS

QUESTIONS and ANSWERS

About Dielectric Sand Core Drying

1. *How does the core dry?*
By passing high frequency currents through the moist sand, the molecules are set in motion and the resultant friction generates sufficient heat to drive off the moisture from the inside.

2. *Why are resin binders used in place of core oils?*
Core oils require high temperatures and long drying time for complete polymerization. Resin binders cure at lower temperatures . . . approximately 250° F.

3. *What about collapsibility?*
Resin bonded cores have very good collapsibility, contributing to a faster, cleaner shakeout.

4. *I want a very hard core, but still have good collapsibility. What do I do?*
Spray the cores with a film of moisture just before putting on conveyor belt. This will give high surface hardness without affecting the collapsibility.

5. *Can core wash be eliminated?*
In many cases, yes. The resin forms a reducing atmosphere resulting in smooth castings, without necessity of applying core wash.

6. *Is any special or additional equipment needed?*
None, except plastic dryers to hold shaped cores. Marinite or transite plates are recommended.

7. *Can metal dryers or plates be used?*
Yes, but it will result in reduced production. The metal will act as a shield around the sand, requiring the core to be run a second time without the dryer or plate.

8. *I have metal dryers which I do not want to replace at once. Can I use them?*
Yes. Run the cores through in the normal manner. Turn the cores out on plates and remove the dryer and run the cores through again.

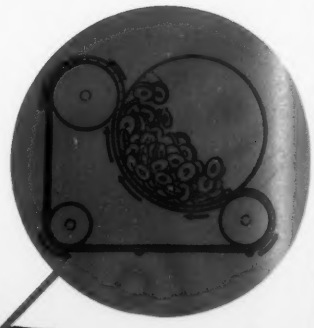
9. *How many plastic dryers will be needed?*
Far less than the normal amount of metal dryers. A maximum of 50 plastic dryers should suffice for each job unless more than one coremaker is working on the same job.

Allis-Chalmers
Milwaukee 1, Wisconsin

Please send me new 8-page booklet 15B7306B containing complete information on the *Foundromatic* sand core dryer.

Name .....
Title .....
Company .....
Street .....
City ..... State .....

WHEELABRATOR® TUMBLAST



the largest
WHEELABRATOR
TUMBLAST
63 cu. ft.
capacity

MEMBER FEMA FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION, INC.

WORLD'S LARGEST BUILDERS OF AIRLESS BLAST EQUIPMENT

HAS REVOLUTIONIZED BLAST CLEANING FOR 26 YEARS

• FIRST with endless belt conveyor

• *4350 ENTHUSIASTIC USERS*

The *original* airless batch mill that transformed metal cleaning to a mass production operation over 26 years ago, is still the fastest, most thorough and most economical cleaning method today. Constant improvements have been made in the Wheelabrator Tumblast, still its *basic engineering features* have always proved to be years ahead of other designs.

For instance, the endless conveyor method of tumbling the work and the incomparable Wheelabrator unit have saved thousands of dollars in operating and maintenance costs for more than 4350 Tumblast users. Work is gently cascaded in a continuous cycle beneath the blast stream so that all surfaces of every piece are exposed to the full effect of the cleaning action.

American's engineering leadership and vast experience with the proven Wheelabrator Tumblast is your *absolute assurance* of a thorough, fast and economical cleaning job.

there's a WHEELABRATOR TUMBLAST for every size foundry

8 SIZES TO CHOOSE FROM

THE AMERICAN WOLDER TRADEMARK

American

WHEELABRATOR & EQUIPMENT CORP.
505 S. Byrkit St. Mishawaka, Indiana

SEND FOR THIS TUMBLAST CATALOG

Catalog No. 254-A is a comprehensive guide to airless batch mill cleaning. It describes the advantages of the Tumblast and illustrates the 8 standard sizes as well as the Continuous Automatic Tumblast. Send for your copy today.

Advertisement

ELECTROMET Data Sheet

A Digest of the Production, Properties, and Uses of Steels and Other Metals

Published by Electro Metallurgical Company, a Division of Union Carbide and Carbon Corporation, 30 East 42nd Street, New York 17, N. Y. • In Canada: Electro Metallurgical Company of Canada, Limited, Welland, Ontario.

Why 3 Per Cent Chrome Steel Makes Good Castings for Wear Resistance

Castings of 3 per cent chromium steel have been used in substantial tonnages, for many years, for various equipment parts demanding good wear resistance. Such castings offer an excellent combination of hardness and toughness. Typical applications are crusher parts used in rock- and ore-crushing equipment, swing hammers for pulverizing coal, railroad switch frogs, gears, pulleys, sheaves, and other castings that must meet severe conditions of wear.

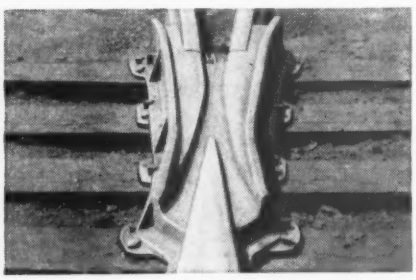


Fig. 1. Railroad switch frogs, which are subject to severe wear, give outstanding service when cast of 3 per cent chromium steel.

The 3 per cent chromium steels, are normally produced in a carbon range of 0.30 to 0.50 per cent. They exhibit excellent depth-hardening properties, which simplify heat-treatment and insure uniformity throughout heavy sections. The analysis is usually modified by a molybdenum addition, since this element aids in increasing hardenability.

Fig. 2. Grating for top of shake-out machine is cast of 3 per cent chromium steel to give good wear resistance and long life.

Properties Improved by Heat-Treatment

The best properties of 3 per cent chromium steels are developed through heat-treatment. Generally, this consists of a normalizing treatment from 1650 deg. F., followed by tempering in a range between 1000 and 1250 deg. F., depending on the physical properties desired. Double normalizing is sometimes used to obtain further improvement in the grain structure. With carbon on the high side of the specification, air-quenched castings show a Brinell hardness number of over 400 in 3-inch sections. This hardness is practically uniform throughout the section. Oil quenching is employed to produce higher hardness and depth of penetration, and even in a 4-inch section, a hardness number of over 500 Brinell is obtained.

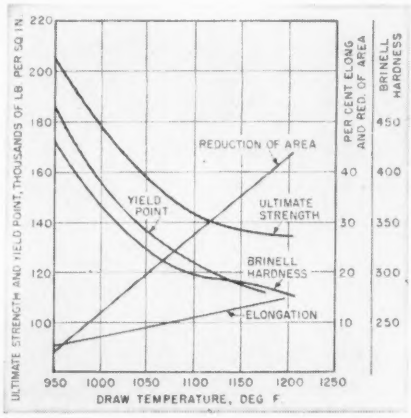


Fig. 3. These curves show the response to tempering of a 0.37 per cent carbon, 2.93 per cent chromium, 0.35 per cent molybdenum steel previously normalized from 1650 deg. F.

The steel also shows good response to tempering. After a normalize and a 1100 deg. F. treatment, it has a tensile strength close to 150,000 pounds per square inch, with an elongation value of about 12 per cent, and a Brinell hardness of about 300. When greater ductility is required, tempering should be done at higher temperatures. However, in such instances, some strength and hardness are sacrificed.

Fig. 4. Photomicrograph of 3 per cent chromium steel normalized from 1650 deg. F. and tempered at 100 deg. F. (X250). The pseudo-martensitic structure is well suited to resist abrasion.

Effect of Other Alloy Additions

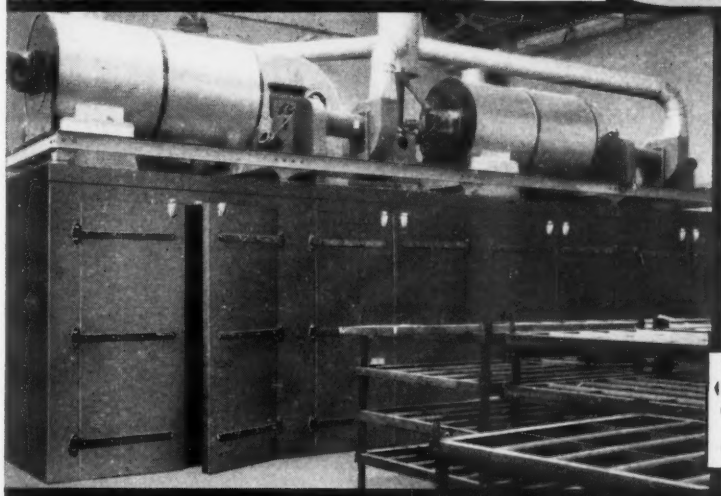
Molybdenum in the range from 0.30 to 0.50 per cent will improve depth-hardening characteristics and aid in reducing susceptibility to temper brittleness in the lower temperature ranges. If the molybdenum-bearing steel contains relatively high carbon (0.40 to 0.60 per cent) additions of approximately 0.08 to 0.10 per cent vanadium provide greater uniformity in hardening. Small additions of silicon increase strength and hardness and this element is sometimes increased to 0.80 or 1.00 per cent. Manganese is added in amounts between 0.50 and 0.80 per cent.

Metallurgical Service Available

When you have occasion to produce castings for applications involving severe abrasion and wear, it will pay you to investigate the advantages of using 3 per cent chromium steel. If you need help on some specific metallurgical problem, be sure to consult one of ELECTROMET's specially trained metallurgists and engineers. For further information, write to the nearest ELECTROMET office: in Birmingham, Chicago, Cleveland, Detroit, Los Angeles, New York, Pittsburgh, or San Francisco. In Canada: Welland, Ontario.

The term "Electromet" is a registered trademark of Union Carbide and Carbon Corporation.

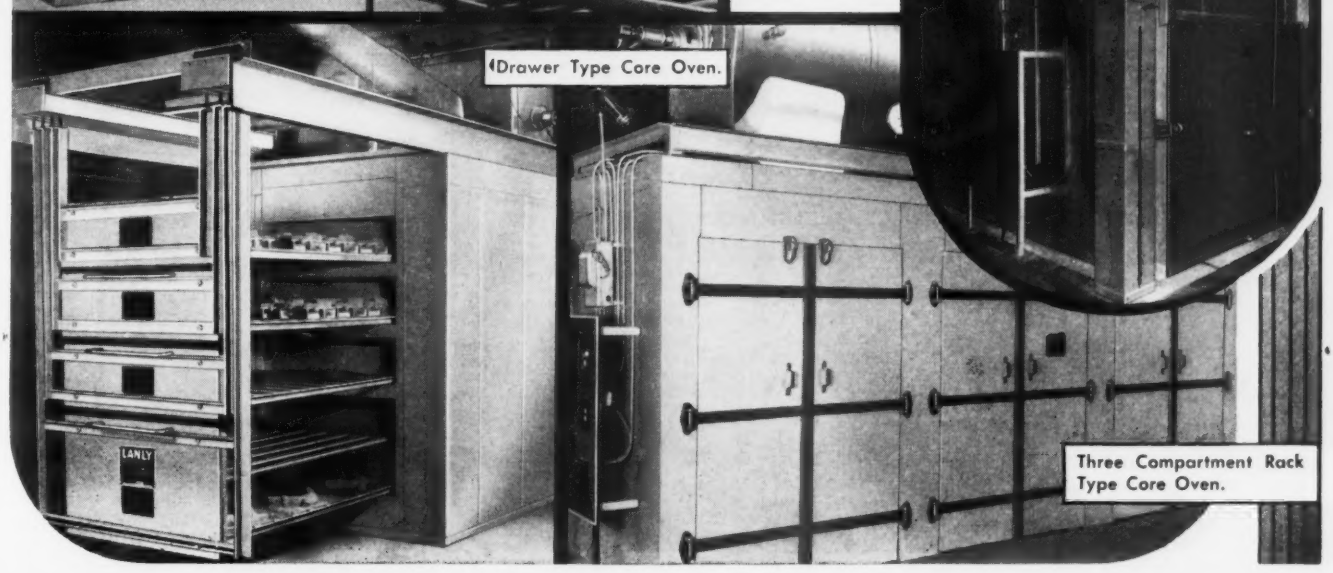
Two Compartment Car Type Mold Drying Oven.
Two Compartment Rack Type Core Oven.
Single Compartment Rack Type Core Oven.
LANLY
FOUNDRY OVENS
THE LANLY COMPANY • 780 PROSPECT AVE
CLEVELAND, OHIO



The Lanly reputation has been established as the result of the consistent incorporation of advanced, efficient design and high grade construction into every Lanly installation.

Core baking, pasting and mold drying ovens as well as casting conditioning and heat-treating ovens are available in standard units.

Write for Literature and Complete Information.

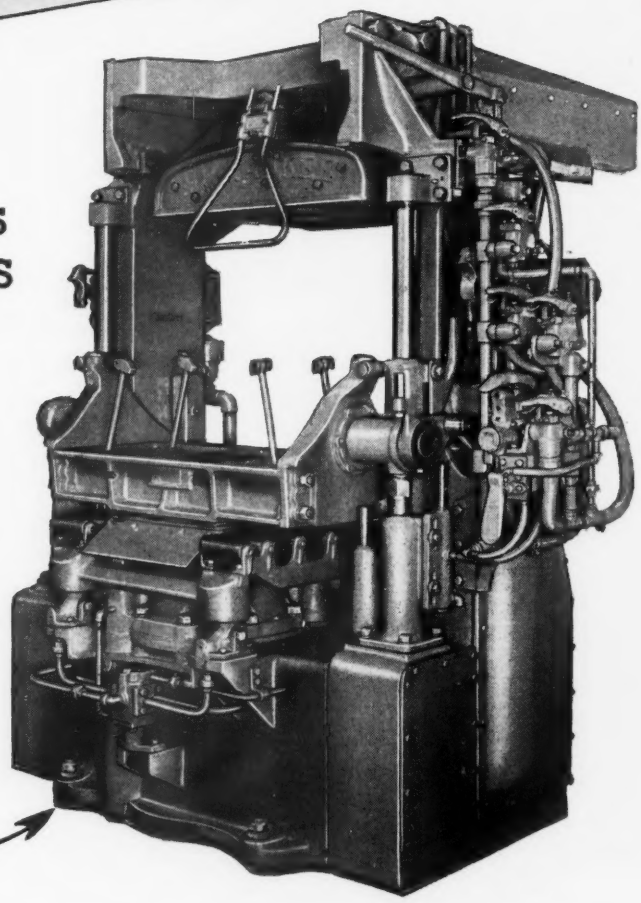


Under Jolt Moulders

FABREEKA

REDUCES
THE DESTRUCTIVE EFFECTS
OF HEAVY IMPACT SHOCKS
AND VIBRATION . . .

CROSS SECTION OF FABREEKA INSTALLATION



FABREEKA Pads, bushings, and washers are installed under Jolt Moulders, Shakeout Machines, Tumbling Barrels and other heavy machinery to reduce the effects of heavy impact shocks and destructive vibration.

FABREEKA has demonstrated its ability to prevent breakage of machine parts and to keep bolts tight, thereby reducing maintenance and increasing production.

In addition to these important advantages, Fabreeka has long life, which makes its final cost a low cost.

Write for latest literature

It Pays to Specify Fabreeka

FABREEKA PRODUCTS COMPANY, INCORPORATED
222B Summer Street
Boston 10, Mass.

for IMPACT SHOCK and VIBRATION

Protection by TOUSEY!

TOUSEY Casting Sealers offer protection to bell housings against many forms of abuse, preventing excessive wear and extending their period of usefulness. Sealers of this type must be non-toxic and non-bleeding and must not chip or crack away from machined surfaces. ★ Tousey Varnish Company offers its many customers another type of protection — that of the Quality of its products and the assurance that high manufacturing standards shall be maintained at all times — a protection of 69 years standing.

TOUSEY PRODUCTS

CASTING SEALER

THE TOUSEY VARNISH COMPANY

520 WEST 25TH STREET • CHICAGO 16, ILLINOIS

NEW . . . IMPROVED

HEAVY DUTY M

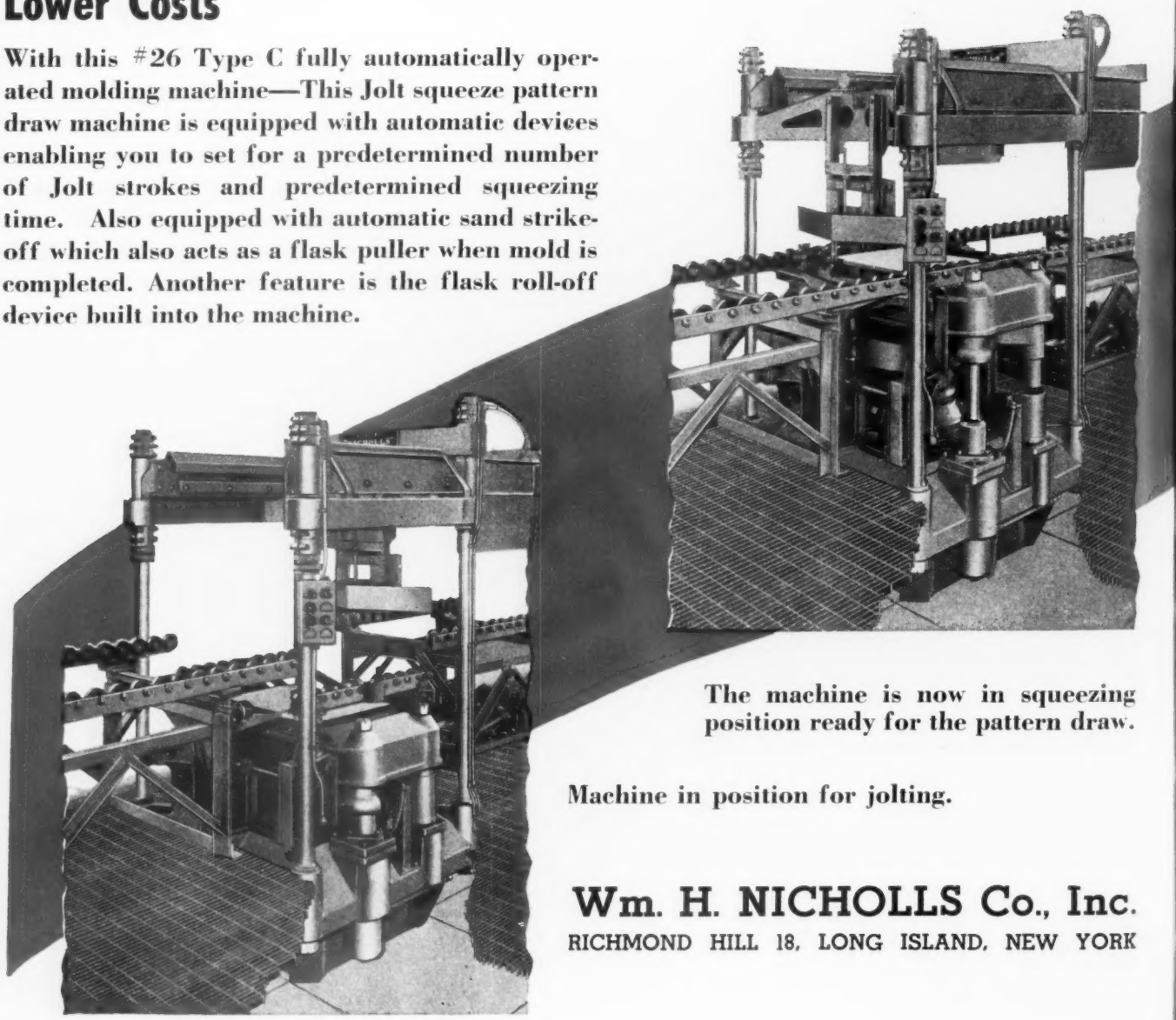
JOLT—SQUEEZE— an

Equipped with "Safety" Pu

for fully automatic ope

Increase Production . . . Lower Costs

With this #26 Type C fully automatically operated molding machine—This Jolt squeeze pattern draw machine is equipped with automatic devices enabling you to set for a predetermined number of Jolt strokes and predetermined squeezing time. Also equipped with automatic sand strike-off which also acts as a flask puller when mold is completed. Another feature is the flask roll-off device built into the machine.



The machine is now in squeezing position ready for the pattern draw.

Machine in position for jolting.

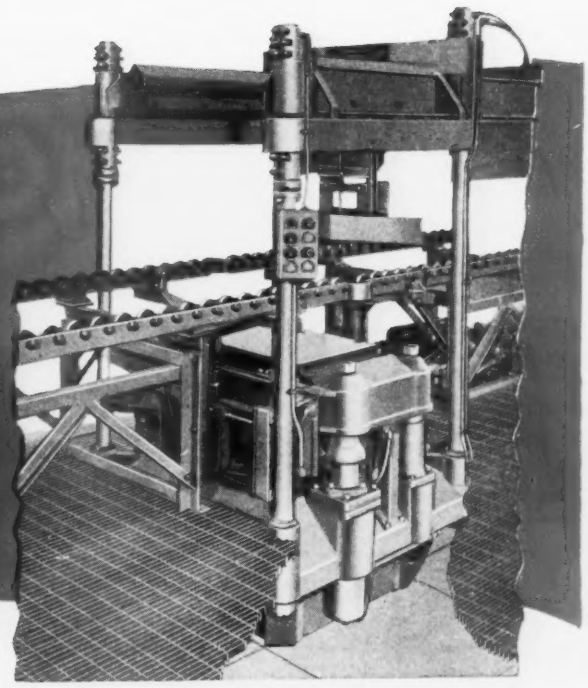
Wm. H. NICHOLLS Co., Inc.
RICHMOND HILL 18, LONG ISLAND, NEW YORK

MOLDING MACHINES

and PATTERN DRAW

Push-Button Controls

operation



MAKES MOLDS in SECONDS

LOW UPKEEP

All draw pins and guide bushings are case hardened and ground to precision tolerances for perfect fit and smooth operation. An accurate system of gages and jigs provides interchangeability of parts for the same models.

The low upkeep records of hundreds of foundries attest for foresight of Nicholls' Engineers in designing inbuilt features that make for long life and accurate, dependable performance after years of service. As an instance, we point to the dirtproof housings and forced lubrication that are provided for all critical parts that might otherwise wear quickly and affect permanent alignment and satisfactory operation.

The international acceptance of large numbers of Nicholls' molding machines for many years is evidence of their productive capacity, combined with low upkeep and reliability.

Write for Literature

The pattern has been drawn, the pressure head returns to the out position and automatically pulls the finished mold onto the roller extension.

GUARANTEED WORKMANSHIP

Smooth sensitive operation is built into all moving parts of Nicholls molding machines by expert mechanics, skilled in their specialized tasks. Close tolerances assured by a system of accurate jigs and fixtures.

NICHOLLS

Bill— you can cut drying time with Mogul!

LARGEST SELLER IN THE FIELD!

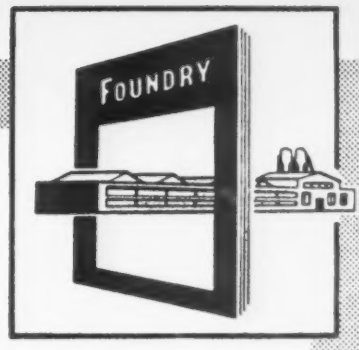
Kordek, the preferred dry bond for cores . . .

• MAKES SMOOTHER CORES • CUTS DOWN DISCARDS

Full technical service, without obligation, is available to show how you can profit from the use of MOGUL® Cereal Binder in your production.

Write Technical Sales Department

CORN PRODUCTS REFINING COMPANY • 17 BATTERY PLACE, N. Y. 4, N. Y.



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Cleveland, Ohio

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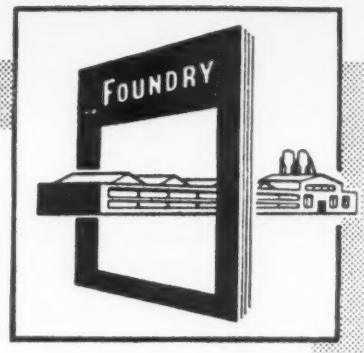

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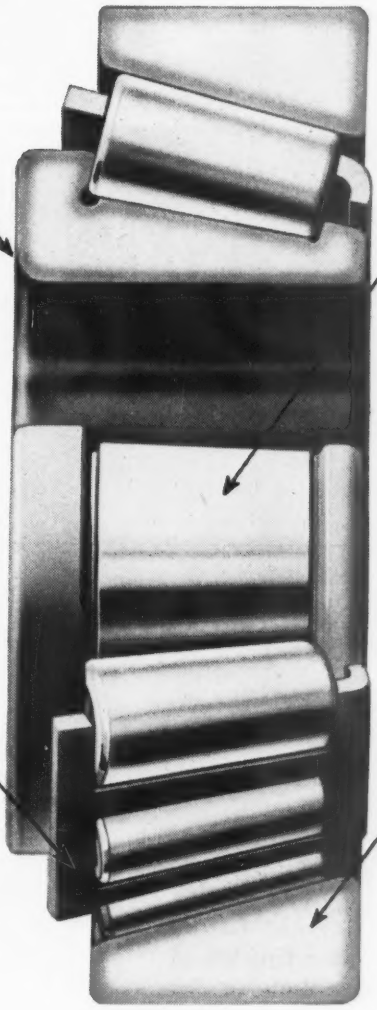
Our staff will forward this information to the advertiser immediately so you'll be relieved of the necessity of writing several letters. You'll hear from the advertiser directly, answering your request.

FOUNDRY
Readers Service

If you want all this in a tapered roller bearing . . .



1 **GENEROUS RADIUS**—for greater shaft strength.

2 **CHOICE OF 26 DIFFERENT TYPES.**

3 **SOFT STEEL CAGE**—to keep rollers separate and prevent scuffing.

4 **PRECISION MANUFACTURE**—which makes possible bearings with a maximum runout tolerance of less than 75 millionths of an inch.

5 **CASE-HARDENED BEARING SURFACES**—to resist wear.

6 **MICRO-INCH SURFACE FINISH**—to minimize friction.

7 **CHOICE OF 5850 SIZES.**

8 **TIMKEN FINE ALLOY STEEL**—specially developed to give long bearing life.

9 **TOUGH CORE**—to resist shock.

10 **POSITIVE ROLLER ALIGNMENT**—to prevent skewing and give maximum capacity.

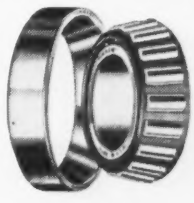
. . . the tapered roller bearing you want is TIMKEN®

TIMKEN® tapered roller bearings give you more advantages than any other make. Ten of these advantages are listed above. They result from the fact that the Timken Company is the foremost producer of tapered roller bearings and leads in 1) advanced design, 2) precision manufacture, 3) rigid quality control, and 4) special analysis steels.

Be sure every tapered roller bearing you use carries the name "Timken", the trade-mark of The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ont. Cable address: "TIMROSCO".

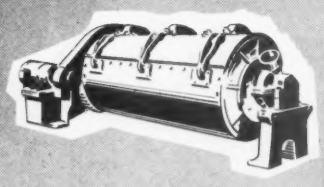
TIMKEN

TAPERED ROLLER BEARINGS

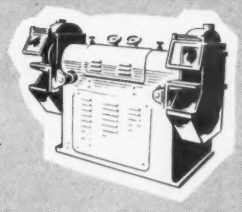


NOT JUST A BALL NOT JUST A ROLLER THE TIMKEN TAPERED ROLLER BEARING TAKES RADIAL AND THRUST LOADS OR ANY COMBINATION

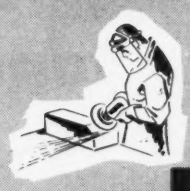
DRACCO FILTERS CONTROL FOUNDRY DUST FROM ALL SOURCES



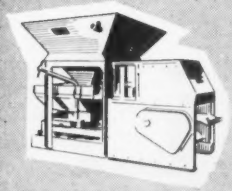
Tumbling mills



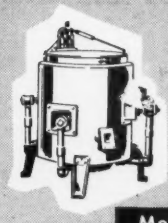
Snagging grinders



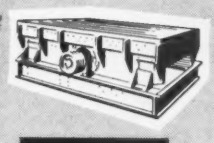
Portable grinders



Sand conditioning equipment



Melting furnaces



Shake-outs

Swing frame grinders

PROVED FOR YOUR FOUNDRY...

..BY *Thousands* OF INSTALLATIONS

High efficiency and long operating life of industrial dust control equipment depend on two important factors: (1) the dust control experience and engineering "know-how" of the manufacturer and (2) the quality of materials and operating life "built into" the system. Thousands of high-efficiency dust control units and systems designed and built by Dracco furnish operating proof of both these factors.

Thirty-five years' experience devoted exclusively to dust and fume control have provided Dracco engineers with invaluable design, engineering, and operating knowledge. This knowledge has enabled Dracco engineers to solve many dust problems—resulting in substantially improved operating conditions in all types of foundries.

When you think of dust control, remember DRACCO—the name, the engineering skill, and the dust control system that will successfully solve your problems.

DRACCO CORPORATION

Harvard Ave. and East 116th St. • Cleveland 5, Ohio

Full information on Dracco equipment as applied to your specific problem may be had by contacting your nearest Dracco representative or Department G-6, Cleveland, O.

DRACCO

Performance Proved

DUST CONTROL EQUIPMENT • PNEUMATIC CONVEYORS

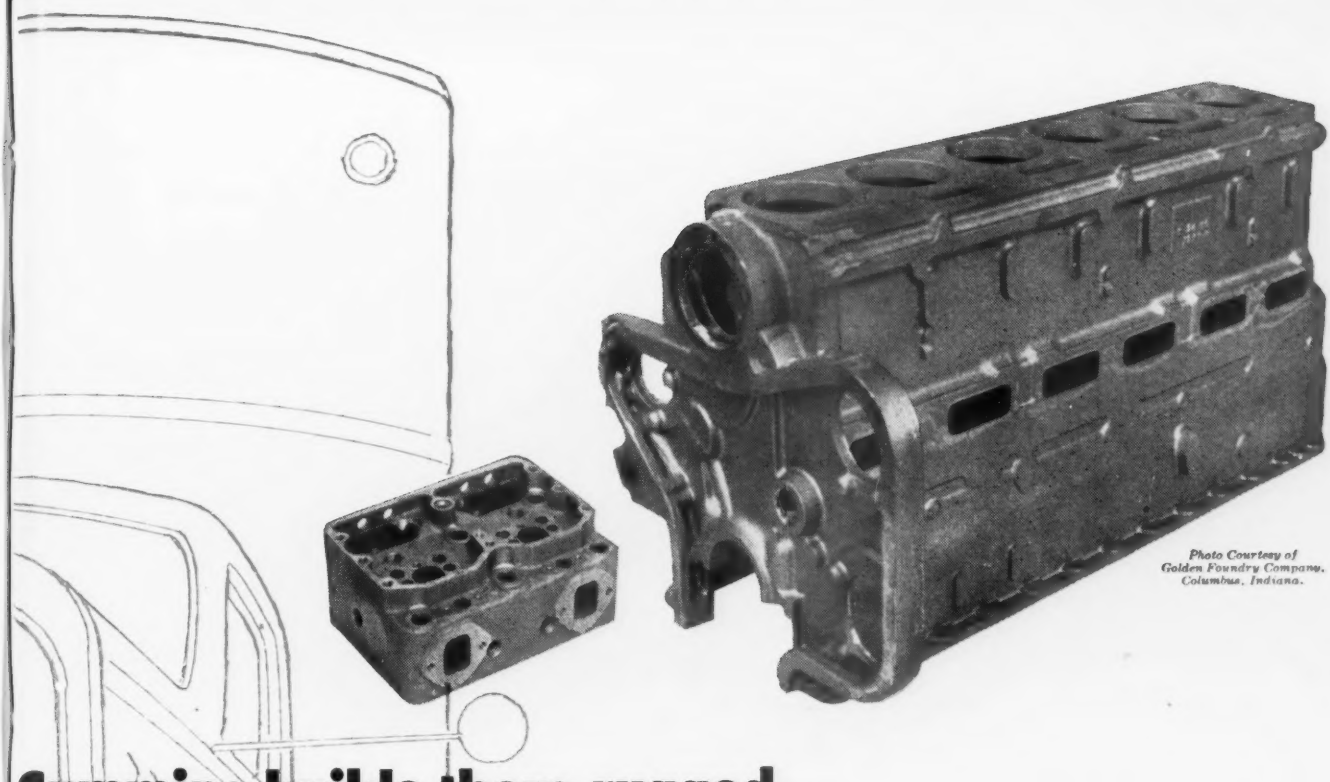


Photo Courtesy of Golden Foundry Company, Columbus, Indiana.

Cummins builds them rugged...

with mighty rigid "Specs"

For rugged dependability, many of the nation's leading truck lines will agree, you can't beat a Cummins Diesel engine. A good reason for that reputation can be found in the rigid requirements for all component engine parts—including the block and cylinder head castings shown above.

To meet these strict requirements, the foundry which furnishes the castings has long made it a point to use only the finest pig iron—including Republic CHATEAUGAY. And the result: *Uniform high strength and machinability throughout every casting,* despite intricate passages and adjoining light and heavy sections.

A Republic Pig Iron Metallurgist will be glad to give you the complete facts about CHATEAUGAY Pig Iron. Write, wire or phone:

REPUBLIC STEEL CORPORATION
GENERAL OFFICES • CLEVELAND 1, OHIO
Export Department: Chrysler Building, New York 17, N. Y.

Republic PIG IRON

"CHATEAUGAY"	"REPUBLIC"	"PIONEER"
Low-Phosphorus, Copper-Free	(Northern) Foundry, Basic and Malleable	(Southern) Foundry and Basic

REPUBLIC STEEL

"EXTRA TOOL LIFE?"
"Absolutely," says a volume producer. "We machine 35% more gray iron castings per tool—when those castings are poured from iron deoxidized with FERROCARBO Briquettes. That's why we've standardized 100% on FERROCARBO."

FERROCARBO

TRADE MARK

Briquettes

by CARBORUNDUM

make your castings CLEANER...MORE UNIFORM...MORE WEAR RESISTANT...MORE RESISTANT TO THERMAL SHOCK...EASIER TO MACHINE (extra tool life)

"Carborundum" and "Ferrocarbo" are registered trademarks which indicate manufacture by The Carborundum Company, Niagara Falls, New York.

PHONE OR WRITE THE FERROCARBO DISTRIBUTOR NEAREST YOU

KERCHNER, MARSHALL & CO.
PITTSBURGH
Cleveland, Birmingham, Philadelphia and Buffalo

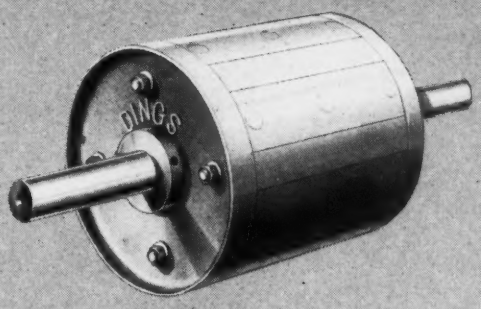
MILLER & COMPANY
CHICAGO
St. Louis and Cincinnati

FERROCARBO Briquettes are manufactured under U.S. Patents 2,119,521 and 2,497,745. U.S. Patent 2,020,171 covers a process of making cast iron through the utilization of FERROCARBO.

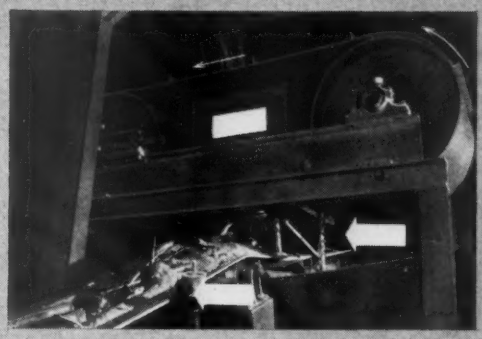
Made in Canada by
CANADIAN CARBORUNDUM COMPANY, LTD.,
Niagara Falls, Ontario

Distributed by WILLIAMS & WILSON, TORONTO,
Montreal and Windsor

and by KERCHNER, MARSHALL & CO., Buffalo, N. Y.



Dings Non-electric, Permanent Perma-Pulley.



Dings Extra Powerful Self Cleaning Rectangular.

1. 2. 3. 4.

Dings All-Welded Cooler Operating Lifting Magnet.

Dings "Holdtite" holds castings in position for swing grinding.

4 WAYS TO CUT HANDLING COSTS

Compare the advantages these Dings magnets offer over your present methods:

1. THE NON-ELECTRIC, PERMANENT PERMA-PULLEY in the sand handling system takes iron out automatically, without attention, without electricity, without maintenance. Perma-Pulleys have no operating expense, are guaranteed to be permanently magnetic. Magnetic strength is certified.

2. THE SELF CLEANING RECTANGULAR FOR THE TOUGHEST JOBS . . . *another sand handling cost-cutter.* Great power enables this magnet to handle particularly difficult iron extraction jobs. For *maximum* iron removal, none can surpass the Dings Rectangular. Self-cleaning feature makes operation automatic—eliminates "carry-over" of sand with iron.

3. LIFTING MAGNET LIFTS 10 TO 100% MORE. Ideal for handling scrap, pig iron, castings, metal flasks, etc. Lifts more because it's cooler operating. All welded, lightweight, moisture-proof, rugged, 4-point chain suspension.

4. "HOLD-TITE" CUTS GRINDING LABOR COSTS UP TO 25%. Firmly holds all shapes of castings up to 1000 lbs. in position for swing grinding. Magnet can be tilted to 7 different positions. Requires practically no maintenance, simple to install. SEND FOR THIS PAPER: *"Lowering Cleaning Room Costs Through Use of Magnetic Chucks"*. Use coupon below.

If you can use the advantages these magnets offer, NOW is the time to act. Deliveries are still better than average.

Dings

DINGS MAGNETIC SEPARATOR CO.
4708 W. Electric Ave., Milwaukee 46, Wisconsin

SEND THIS COUPON
OR DROP A POSTCARD

Dings: Send me Catalog containing full information on

☐ PERMA-PULLEY ☐ LIFTING MAGNET
☐ RECTANGULAR ☐ "HOLD-TITE" plus

Article on "Lowering cleaning room costs through the use of magnetic chucks"

NAME.....

COMPANY.....

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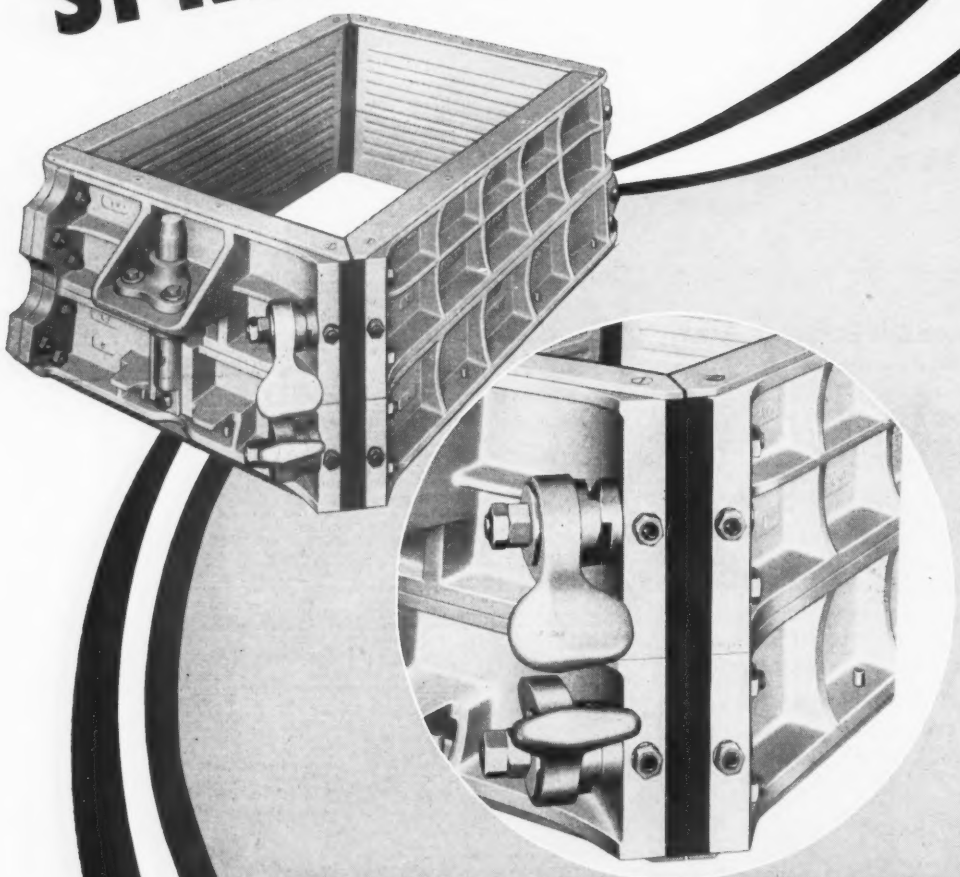
A hit of the Foundry Congress...

Fremont's New

SPREADLOCK FLASK



Long-life, easily replaceable, live rubber corner inserts completely close the corner gaps so that no sand can lodge in the open corners. No springs to break or lose their resiliency.

This great development in flasks also embodies all the many advantages of Fremont's popular standard magnesium slip flasks, being lighter in weight, thus easier to handle and assuring longer service, more exacting work.

Write today for literature.

THE FREMONT FLASK COMPANY

FREMONT, OHIO

"We've more than Doubled Core Production with relatively no rejects"
—says Foundry Head

DESPATCH

TOWER TYPE
CORE OVEN

installed at Progress Pattern and Foundry Co., St. Paul, Minn.

As many as eight tons of sand per eight-hour day can be handled in the modern core making layout at Progress Pattern. Cores of top quality and uniformity for all shapes of brass and aluminum castings are baked in this DESPATCH gas fired, tower type oven with relatively no rejects reported.

"With 80% of our output now going for Defense production it would be impossible to meet the strict time schedules and rigid Government requirements without our high-producing core room equipment," says Progress Management. "For example, our conveyorized Despatch Core Baking Oven with its automatically controlled heat and automatically controlled time cycle eliminates completely the human element in core baking and gives us uniform high-quality cores with every load. With its continuous conveyor, this oven also makes it possible to produce more cores faster with fewer core driers."

NOT TO BE OVERLOOKED in the tower type oven design is the saving in floor space. This oven with 21 conveyor racks extends up approximately 30 ft. It occupies about ¼ the floor space of a horizontal oven of equal capacity.

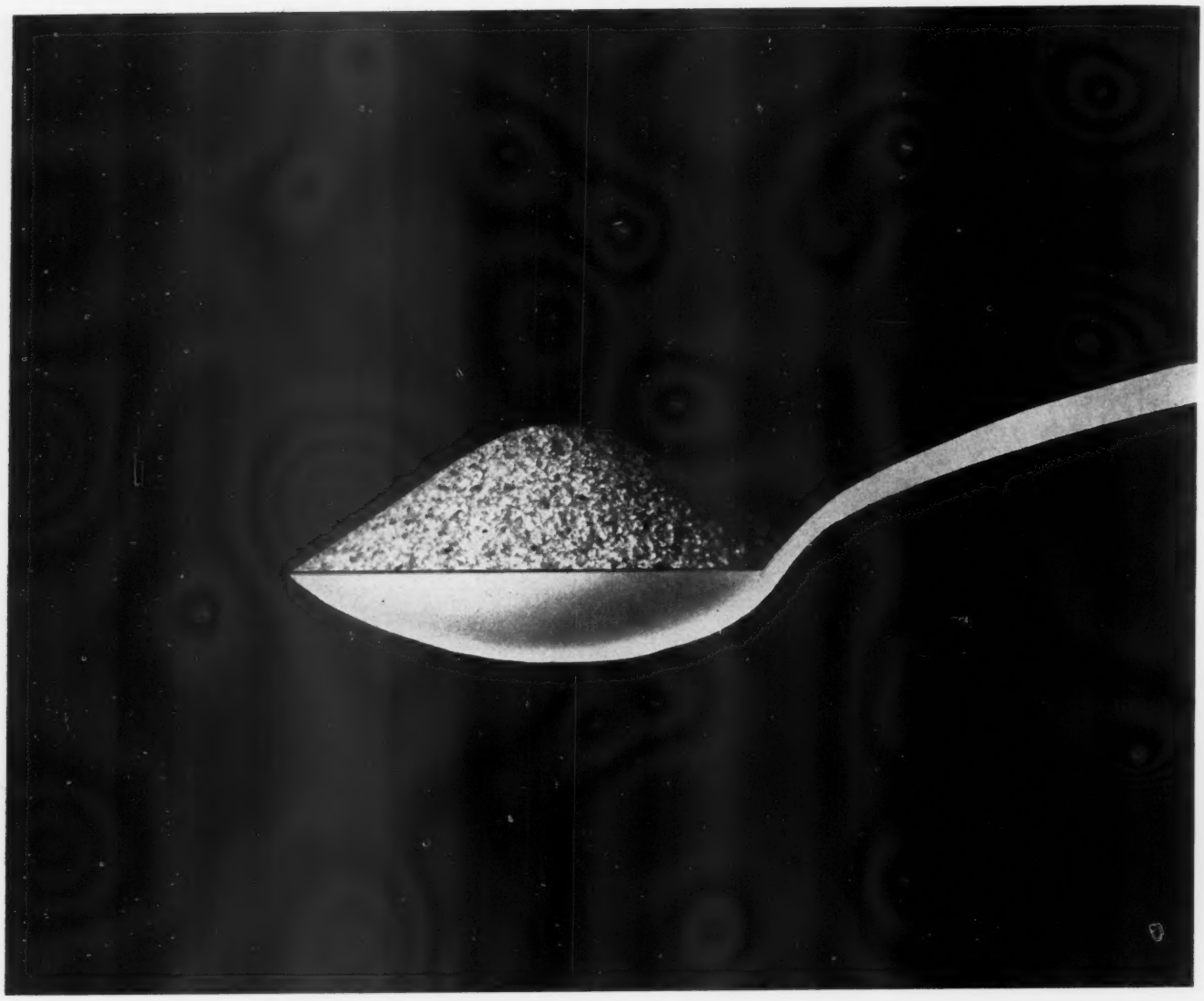
MODERNIZE YOUR FOUNDRY with DESPATCH CORE OVENS FOR MORE PROFIT

Despatch engineers are ready to help you with your foundry problems. They will offer advice, or will design, build and install equipment in your foundry that will provide speed, plus uniformity and economy in all your core baking and mold drying operations.

Write for full information to Dept. N.

FIFTIETH ANNIVERSARY
DESPATCH OVEN COMPANY

MINNEAPOLIS OFFICE: 619 S.E. 8th Street
CHICAGO OFFICE: 4554 N. Broadway
Sales Offices in all Principal Cities



Serve yourself to Savings

Substantial cash savings can be your dish if you reduce your expenditures for new sand. The way to do it is to reclaim your used sand and make it good-as-new. Nichols Sand Reclamation Systems will do the job for you. Write for Bulletin No. 222.

Write to:

Nichols Engineering & Research Corp.

70 Pine St., New York 5, N. Y.
1920 N. Meridian St., Indianapolis 2, Ind.
40 S. Los Robles Ave., Pasadena 1, Calif.
1477 Sherbrooke St., W., Montreal 25, Canada

Nichols

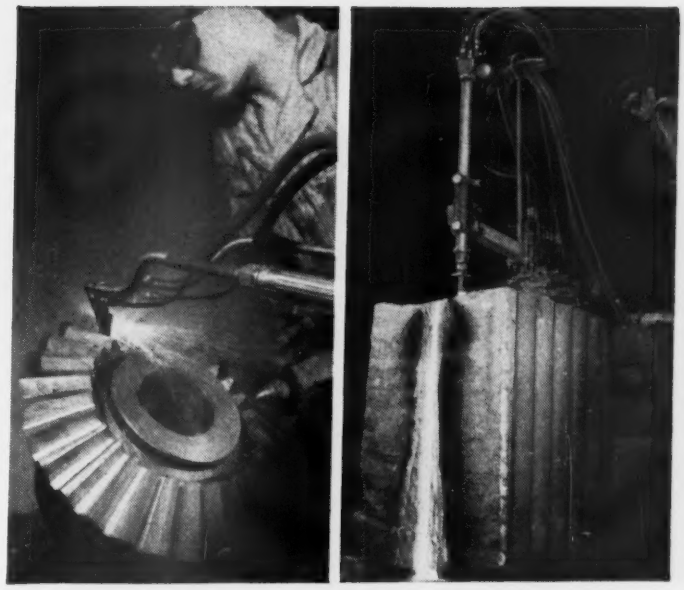
Sand Reclamation Systems

These Metalworking Methods Save Time and Money

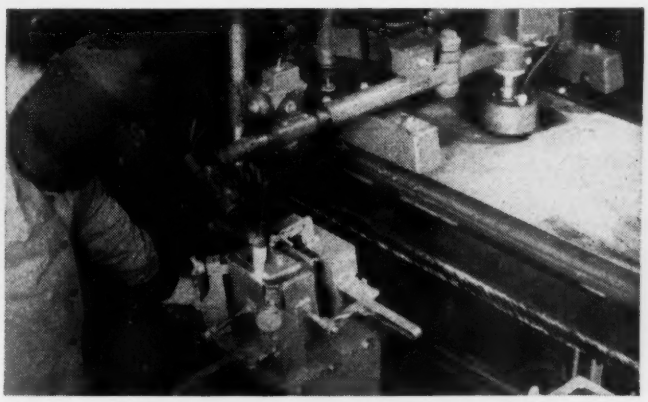
These six methods for keeping production geared to current demands are typical of the many processes and products available through LINDE. Not shown, but equally available to LINDE customers, is the invaluable combination of knowledge, technical skills, and wide practical experience that makes such developments possible.

Whatever you do with metals, there is a good chance that LINDE know-how, show-how, and equipment can help you do it better, quicker, or cheaper. Telephone or write our nearest office today.

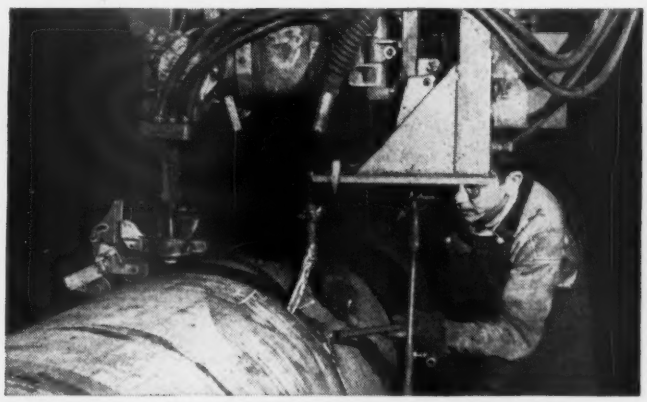
LINDE AIR PRODUCTS COMPANY
A Division of Union Carbide and Carbon Corporation
30 East 42nd Street UCC New York 17, N. Y.
Offices in Other Principal Cities
In Canada: Dominion Oxygen Company, Limited, Toronto



(Left) Flame-hardening gives added service life to parts by providing a hard, wear-resisting surface on a tough, ductile core. (Right) Oxygen-cutting equipment easily slices steel up to 60 in. thick. A 30-in. cut through this 45-in. thick ingot took only 15 minutes.



HELIARC welding in a protective shield of argon or helium gas easily joins hard-to-weld metals such as aluminum, magnesium, stainless steel, and copper alloys. Absence of flux and spatter reduces cleanup and finishing costs.



UNIONMELT welding, a mechanized electric process, joins metals of any thickness without sparks, spatter, smoke, or flash. Welding speeds as much as twenty times greater than by other similarly applicable methods are common.

Powder-scarfing halves conditioning costs on stainless steel. One 8-hr. shift, using two blowpipes, easily powder-scarfs 22 to 24 ingots of 1,000 lb. each.

Plate-edge preparation with OXWELD apparatus makes it possible to cut steel plate to size and bevel the edges for welding in one, quick, oxygen-cutting operation.

Linde Trade-Mark

Products and Processes for MAKING, CUTTING, JOINING, TREATING, AND FORMING METALS

The terms "Heliarc," "Linde," "Oxweld," and "Unionmelt" are registered trade-marks of Union Carbide and Carbon Corporation.

THER-MONIC ADVANTAGES

- Rapid, conveyorized baking with capacities ranging from 500 to 8,000 lbs. of cores per hour.
- Process saves time and labor.
- Requires no oven warm-up time.
- Produces no external heat.
- Over-baked cores are impossible.
- Cores may be used immediately after baking.
- They possess high strength and hardness.
- Good dimensional stability.
- Good green strength without cereal.
- Excellent shakeout characteristics.
- Superior collapsability and permeability.
- Casting rejects are practically eliminated.
- Equipment requires little space.
- Possesses superior thermal efficiency.
- Bakes with lower . . . more precise temperatures.
- Power consumed is proportional to the mass of cores being baked.
- Smoke and fumes minimized.
- Emergency orders can be immediately executed.
- Promotes cleanliness.

THER-MONIC

Electronic CORE BAKING EQUIPMENT

If you maintain a medium to large production core room . . . you should investigate the many advantages of THER-MONIC electronic core baking! As originators of this process and equipment . . . Induction Heating Corporation has the longest record of experience and the greatest number of installations in the foundry field. Let us answer any questions you may have about your own requirements. Inquiries invited!

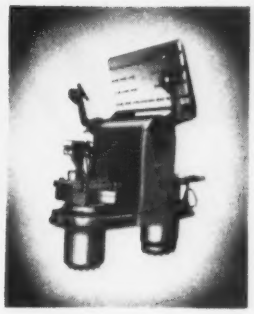
INDUCTION HEATING CORPORATION

181 WYTHE AVENUE · BROOKLYN 11, N. Y.

Largest Producers of Electronic Heat Treating Equipment

On the Sands of Atlantic City

DAVENPORT MOLDING MACHINES



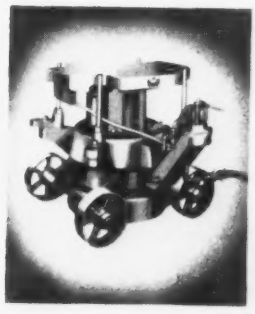
Jolt Rollover Draw, Model A

Yes—it was a great convention!
New Ideas—New Developments—New Equipment

DAVENPORT DISPLAY
The Davenport line of foundry molding machines attracted their share of attention.

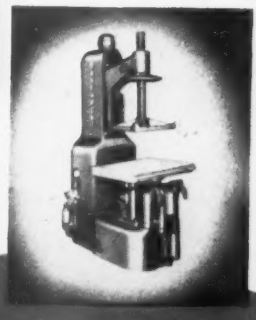
ROLLOVER DRAW
This machine—with its entirely enclosed mechanism—proved up to every expectation. Foundry men from near and far agreed that the Davenport Rollover Draw has everything.

JOLT PIN LIFT
It really made an impression. It's one of the most versatile machines made to produce drag molds as well as copes.



Jolt Pin Lift, Model AJS (portable)

THE NEW JOLT SQUEEZE STRIP
The reaction to this new model molding machine was almost unbelievable. Many blinked their eyes to be sure that the rugged time-saving unit was a reality



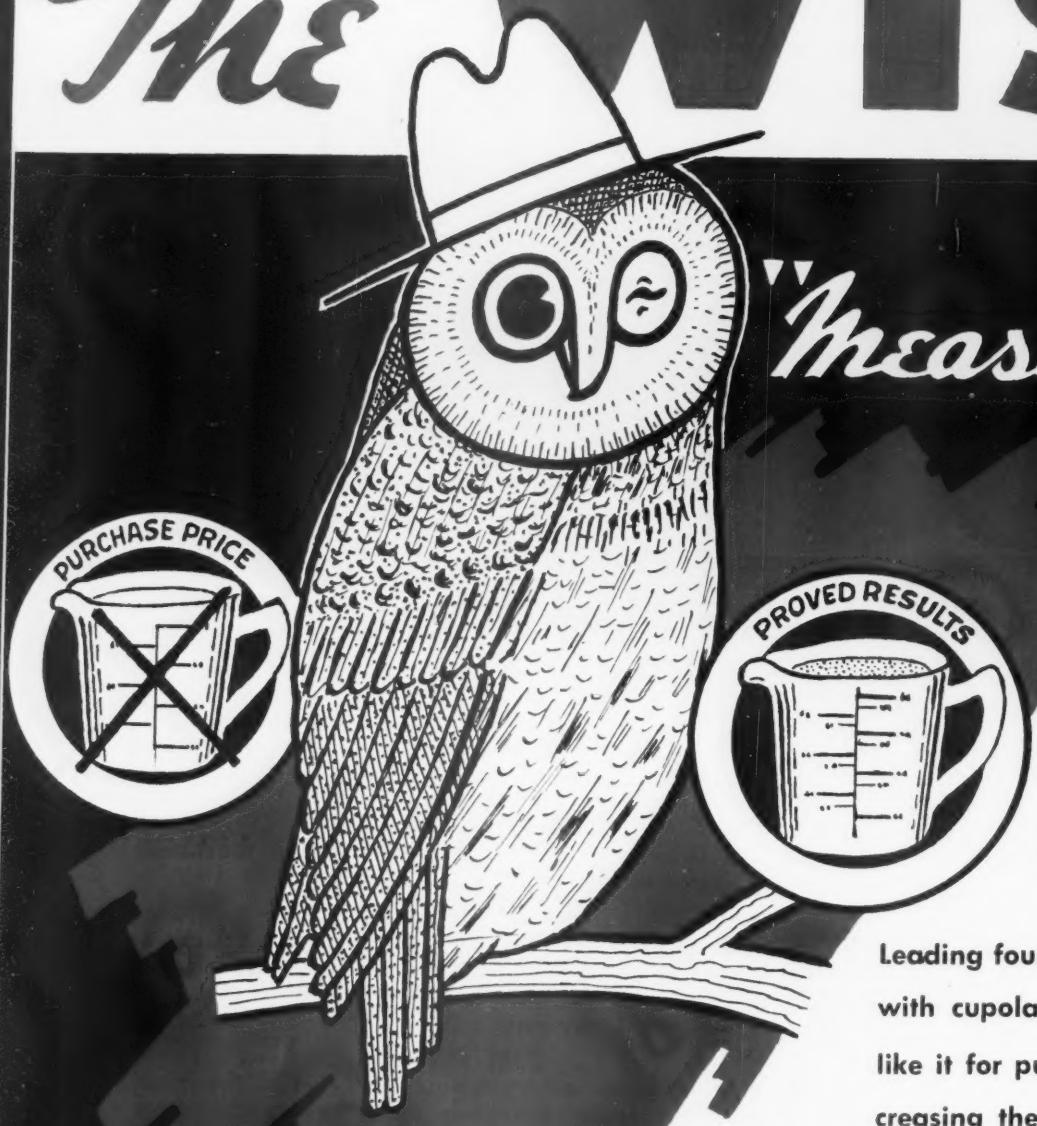
NEW CATALOG
Davenport has a new catalog that we would like to send to you. Just drop us a line . . . and you can sit in your office and review the Davenport line of foundry molding machines. They are built to give you good molds at lower cost.

Jolt Squeeze, Model 13-JY

DAVENPORT MACHINE AND *Foundry Company*
DAVENPORT IOWA U.S.A.

The WISE

"Measure valu



Famous

CLEANSES MOLTEN IRO

Leading foundries—gray iron and malleable with cupolas, will tell you there's nothing like it for purifying, desulphurizing, and increasing the fluidity of molten iron.

To n
in q
foun
appl

Fam
OUG
clean
casti

ANO
Cupo
cost.
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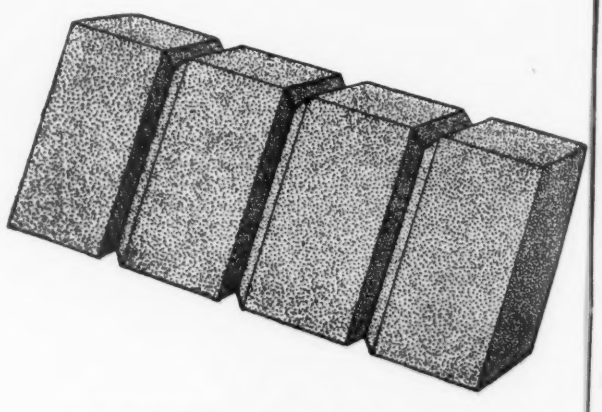
stone
cupol



SCORED BRICK FORM

For easy and most accurate fluxing of molten iron. Practically no labor is required and there is no waste. It takes but a few seconds to lift Famous Cornell Cupola Flux out of container and toss it into cupola with each ton charge of iron. Where charges are smaller or fractional, break off one to three briquettes (quarter sections) as per instructions, to obtain the correct amount for the charge.

FAMOUS CORNELL CUPOLA FLUX IS BACKED BY A RECORD OF MORE THAN 34 YEARS' SUCCESS IN CASTING IMPROVEMENT

Th
1026-1

Foundryman Says

uby results--not price"

CORNELL CUPOLA FLUX

RON FOR BETTER CASTINGS

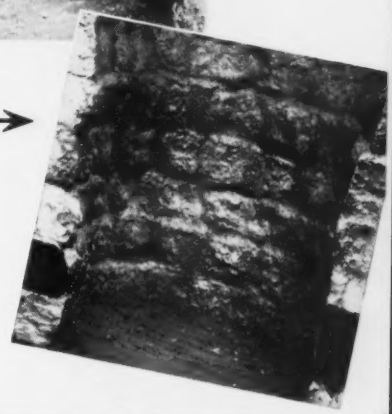
To match some prices, it would be necessary for us to cut corners in quality and sacrifice best results. This we will not do to the foundry industry—and hundreds of foundries have shown their appreciation by being our regular customers for years.

Famous Cornell Cupola Flux has a reputation for doing a THOROUGH job of removing impurities from molten iron, so that only clean metal reaches the molds. The result is cleaner, sounder castings (minimum rejects) and improved machinability.

ANOTHER IMPORTANT ADVANTAGE in using Famous Cornell Cupola Flux, is greatly reduced down time and maintenance cost. Cupolas are kept cleaner. Bridging over is practically eliminated. Drops are cleaner. And there is less erosion of brick or stone, due to a glazed or vitrified surface which is formed on cupola lining.

WRITE FOR BULLETIN NO. 46-B

← THE CUPOLA before using Famous CORNELL Cupola Flux.



→ THE CUPOLA during use of Famous CORNELL Cupola Flux.

The Cleveland Flux Co.

1026-1040 MAIN AVENUE, N. W., CLEVELAND 13, OHIO

Manufacturers of Iron, Semi-Steel, Malleable, Brass, Bronze, Aluminum and Ladle Fluxes - Since 1918

FAMOUS CORNELL FLUXES
Trade Mark Registered

BRASS FLUX

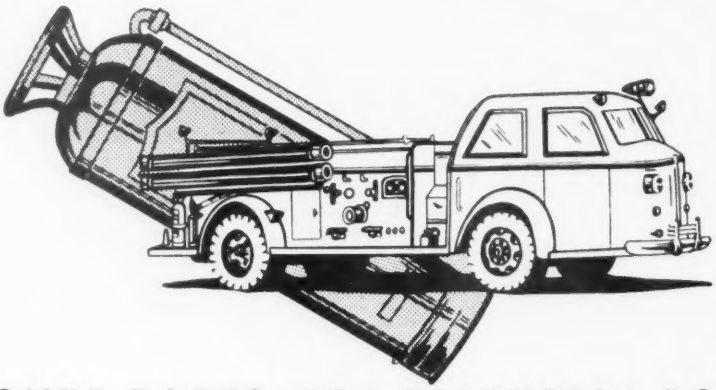
FAMOUS CORNELL BRASS FLUX cleanses molten brass eve when the dirtiest brass turnings or sweepings are used. Yo pour clean, strong castings which withstand high pressur tests and take a beautiful finish. The use of this flux save considerable tin and other metals, and keeps crucible and fu nace linings cleaner, adds to lining life and reduces maintenanc

ALUMINUM FLUX

FAMOUS CORNELL ALUMINUM FLUX cleanses molten aluminu so that you pour clean, tough castings. No spongy or poro spots even when more scrap is used. Thinner yet stronger sec tions can be poured. Castings take a higher polish. Exclusiv formula reduces obnoxious gases, improves working condition Drass contains no metal after this flux is used.

Why *Brass* can better serve your needs

Unfailing Dependability



BRONZE PARTS ARE ESSENTIAL FOR FIRE FIGHTING EQUIPMENT . . . .

Fire fighting apparatus and other emergency equipment must be ready to perform when the occasion demands. Well designed parts . . . pumps . . . valves and fittings are made of bronze to avoid performance failures. Pressure tightness, resistence to corrosion, strength, ductility and anti-frictional characteristics are some of the qualities required.

Wherever liquids are used . . . in the Home or Industry . . . bronze parts play a vital role.

FREE . . . Write for your copy of the 8-page Lavingot Technical Journal — Vol. 8, No. 1 — containing an article discussing "Effects of Various Elements in Manganese Bronze."

Specify—LAVIN NONFERROUS INGOT—*Quality*

Brass · Aluminum · Bronze · Zinc Base Die Casting Alloys

R. LAVIN & SONS, INC.

- *Refiners of Brass, Bronze and Aluminum*
- *Producers of Zinc Base Die Casting Alloys*

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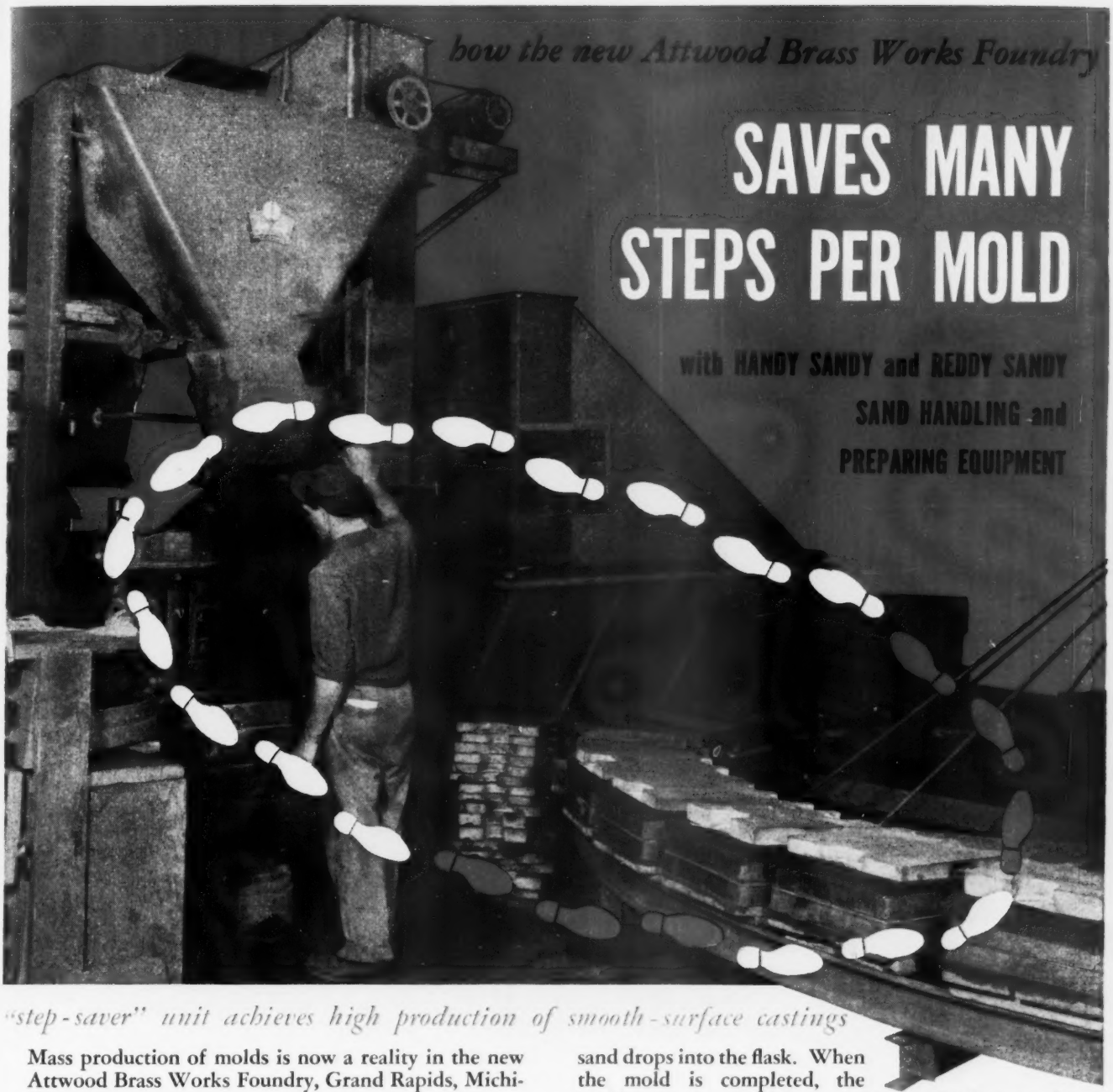
REPRESENTATIVES IN PRINCIPAL CITIES

R. LAVIN & SONS, INC. 1900 52 Years 1952 SERVING THE FOUNDRY INDUSTRY



"step-saver" unit achieves high production of smooth-surface castings

Mass production of molds is now a reality in the new Attwood Brass Works Foundry, Grand Rapids, Michigan. *Every unnecessary step and waste motion has been eliminated* from the complete cycle of sand preparation, molding, pouring and shake-out.

Shake-out and sand preparation are performed in *one operation* with a Reddy Sandy. Molds are dumped on its vibrating shake-out deck where sand and castings are separated. The sand is then *automatically* screened, tempered, and aerated *without further handling.* The unusually thorough conditioning of the sand by the Reddy Sandy is extremely important to Attwood because the majority of their castings are either polished or plated.

Sand is elevated and aerated into the overhead hoppers of the Handy Sandy to eliminate all shoveling by the molder. He merely pulls the gate lever and the sand drops into the flask. When the mold is completed, the molder sets it out with a minimum of effort on the turntable where it is poured. Rotation of the turntable carries the poured molds back to the Reddy Sandy and then the cycle is repeated.

This Attwood installation produces an exceptionally large number of molds per foot of floor space, per man hour. The shakeout, sand conditioning and sand handling units take only 20′ x 6′. The extent of Attwood's varied production is shown by the fact that 4000 different patterns are in use during the year.

The Newaygo Catalog shows how you can mass produce molds at low cost. Send for your copy today.

NEWAYGO ENGINEERING COMPANY

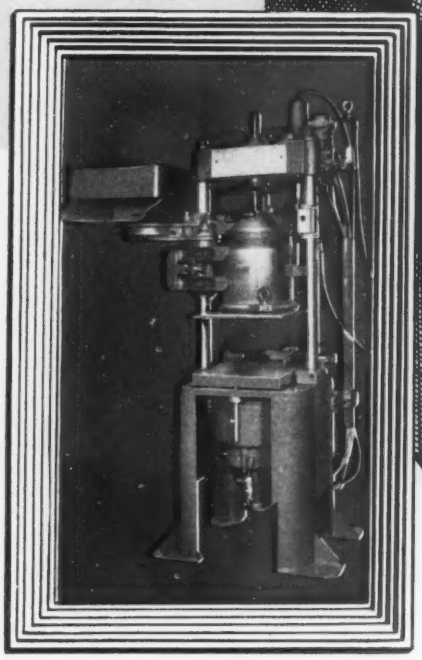
newaygo, michigan

Manufacturers of Neway® Mold Handling, Sand Handling and Conditioning Equipment

HITS of the SHOW

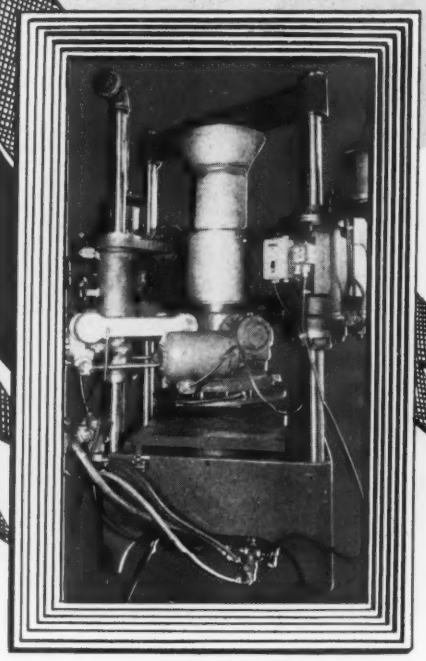
The Complete SAN-BLO

Here they are—the biggest hits of the Atlantic Ci
Foundry Show! Machines that blow cores and mol
weighing from a few ounces to 250 lbs. each. Machin
that blow sand mixtures no other machine can blow
boxes no other machine can blow. If you were unable
attend the show, do the next best thing—write us for lite
ature on these amazing machines. And in the meantim
remember—for *modern* sand blowing, it's the SAN-BL



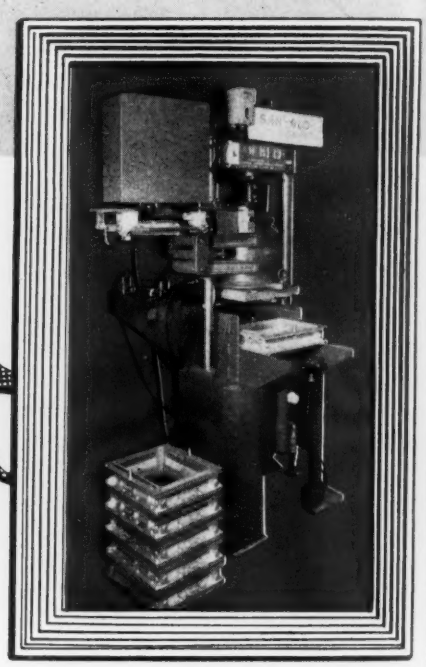
"Pulsator" Core Blower

The star of the SAN-BLO line! The Pulsator blows cores with 2, 3 or 4 quick blows, instead of one continuous blow, so that air pressure in core box is kept extremely low, making it possible to blow wooden or metal boxes without special rigging and, in most cases, without vents.



"250" Core and Mold Blower

The "big 'BLO!" Model 250 SAN-BLO, with Pulsator, produces cores weighing up to 250 lbs. each, using one standard sand magazine. Blows any sand mixture, in **WOOD** or metal boxes. Full automatic operation. Can be equipped to blow stack or cope and drag molds.

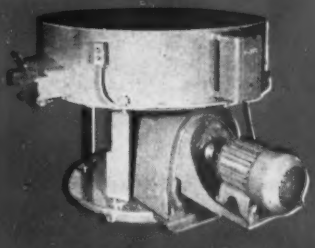


Mold Blower

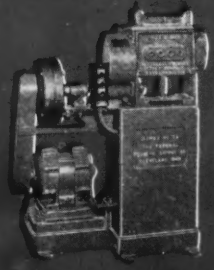
Stack or cope and drag

Sprays the patterns, blows, squeezes, draws and refills automatically—all in 30 seconds. Blowing before squeezing provides more uniform sand distribution, better casting surfaces. Clean operation—no spilling of sand on machine and floor. Flask sizes: 14x14x3 or 12x14x4.

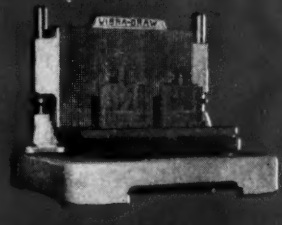
OTHER PRODUCTION-BOOSTING FOUNDRY EQUIPMEN



WHIRLMIX Sand Mixer



CLIMAX Wire Straightener



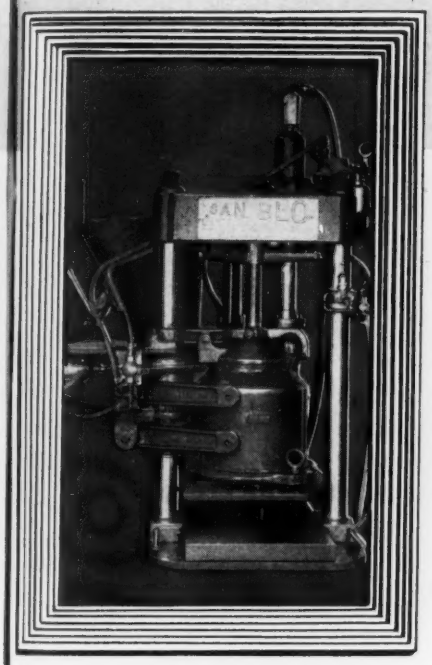
VIBRA-DRAW Core Drawer

Line of Sand Blowers

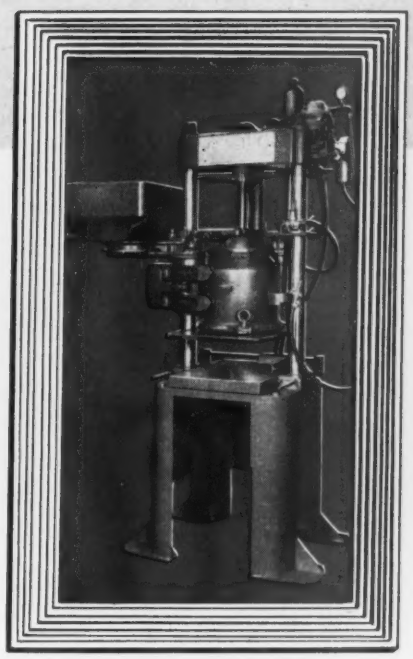
Developed, Manufactured and Sold only by

the FEDERAL FOUNDRY SUPPLY Company

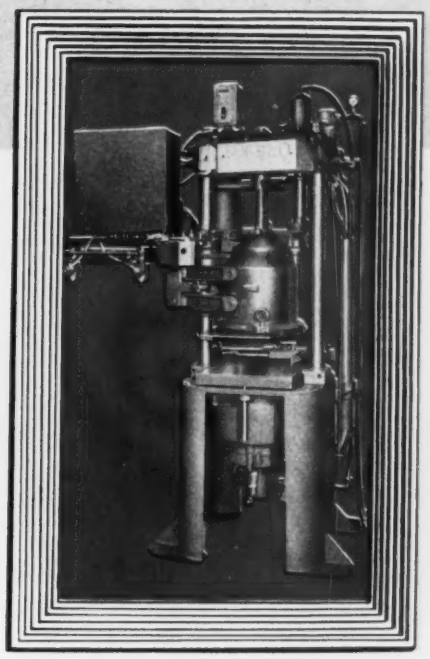
AND AUTHORIZED DISTRIBUTORS



Bench Model



Floor Model



Deluxe Model

1952 STANDARD SAN-BLO CORE BLOWERS . . .

There are 10 variations of each of the above models—a total of 30 models from which to choose. They offer a wide variety of controls and features to suit every possible requirement. All machines blow cores weighing up to 40 lbs. each, with one standard sand magazine. They blow any core sand mixture, with moisture up to 8% and green strength to 12 lbs. Single control. Easily adjusted without tools. You'll get better cores, faster, more economically with a SAN-BLO!

MEMBER FEMA FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION, INC.

. . MADE BY FEDERAL

MIJET Core Blower

FEDERAL

NEW YORK
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CROWN HILL, W. VA.
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THE FEDERAL FOUNDRY SUPPLY COMPANY

4600 EAST 71st STREET • CLEVELAND 5, OHIO

LIGHT COSTS for HEAVY LOADS

up to 15 tons

Where your service requirements do not demand a P&H Heavy-Duty Crane, a Trav-Lift is the sensible answer. They're available in capacities up to 15 tons with various spans and lifting speeds — with floor or cage control.

P&H Trav-Lift Cranes are always tailored to fit your specific needs — with the same safety factors as a heavy-duty crane. Standard, cost-saving designs, combined with many quality features, make the Trav-Lift a modest investment that will pay you big dividends for years to come.

Ask a P&H materials handling engineer to analyze your requirements.

Handle it "thru-the-air" at lower cost.

P&H OVERHEAD CRANE DIVISION

HARNISCHFEGER CORPORATION

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Power Shovels • Crawler and Truck Cranes • Overhead Cranes
Hoists • Arc Welders and Electrodes • Soil Stabilizers
Diesel Engines • Pre-Fabricated Homes

A partial list of companies who have purchased THERMEX Electronic Core-baking Equipment

American Brake Shoe Company
American Hardware Corporation
Brugger Mfg. Company
James B. Clow & Sons
Crane Company
Drake Non-Clinkering Furnace Block Co., Inc.
Ford Motor Company
Fundicao Tupy
Grand Haven Brass Foundry
Grinnell Corporation
Moline Malleable Iron Company
Mueller Company
National Malleable & Steel Castings Co.
Ontario Malleable Iron Co., Ltd.
Phoenix Brass Fittings Corp.
Ronci Co., Inc.
Sterling-Faucet Company
U. S. Pipe & Foundry Company
Walworth Company

Cuts core-baking time!

SINCE replacing conventional gas ovens with THERMEX® Core-baking Equipment, the Walworth Company has greatly increased foundry productivity.

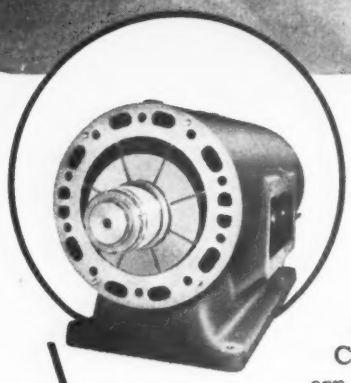
Major improvements in employee working conditions accompany the production boost. The work area is comfortably cool, without oven heat. Cores are cool enough to handle immediately after baking, without danger of burns.

Why not take advantage of the cost-cutting, labor saving advantages of THERMEX Core-baking Equipment? Girdler makes dielectric core-baking equipment in capacities from ½ ton to 15 tons per hour. For complete information write The Girdler Corporation, Thermex Division, Louisville 1, Ky.

The GIRDLER Corporation
THERMEX DIVISION

FULLER ROTARY AIR COMPRESSORS

WORK FOR WESTERN ELECTRIC



Long periods of continuous operation don't overtax these Fuller Compressors at Western Electric Co. plant at Indianapolis, Ind., where two 3300 cfm. two-stage duplex units and one 1665 cfm two-stage single unit supply all plant needs at 100 psig.

Endurance, plus efficiency, are results of the rotary principle employed in these compressors. Elimination of reciprocating parts does away with flow pulsations, cuts down on vibration and need for continual take-up of bearings. Another feature of interest to cost-conscious engineers is the limited maintenance required by Fuller Rotary Compressors—rotor, blades, and bearings are the only moving parts.

Because these compressors do not require valves, top overall efficiency is maintained at all times—no capacity is lost around leaking valves, no time lost to grind seats. Fuller Compressors do not require driving mechanisms nor speed change gears—they are designed to operate at common electric motor and internal combustion engine speeds.

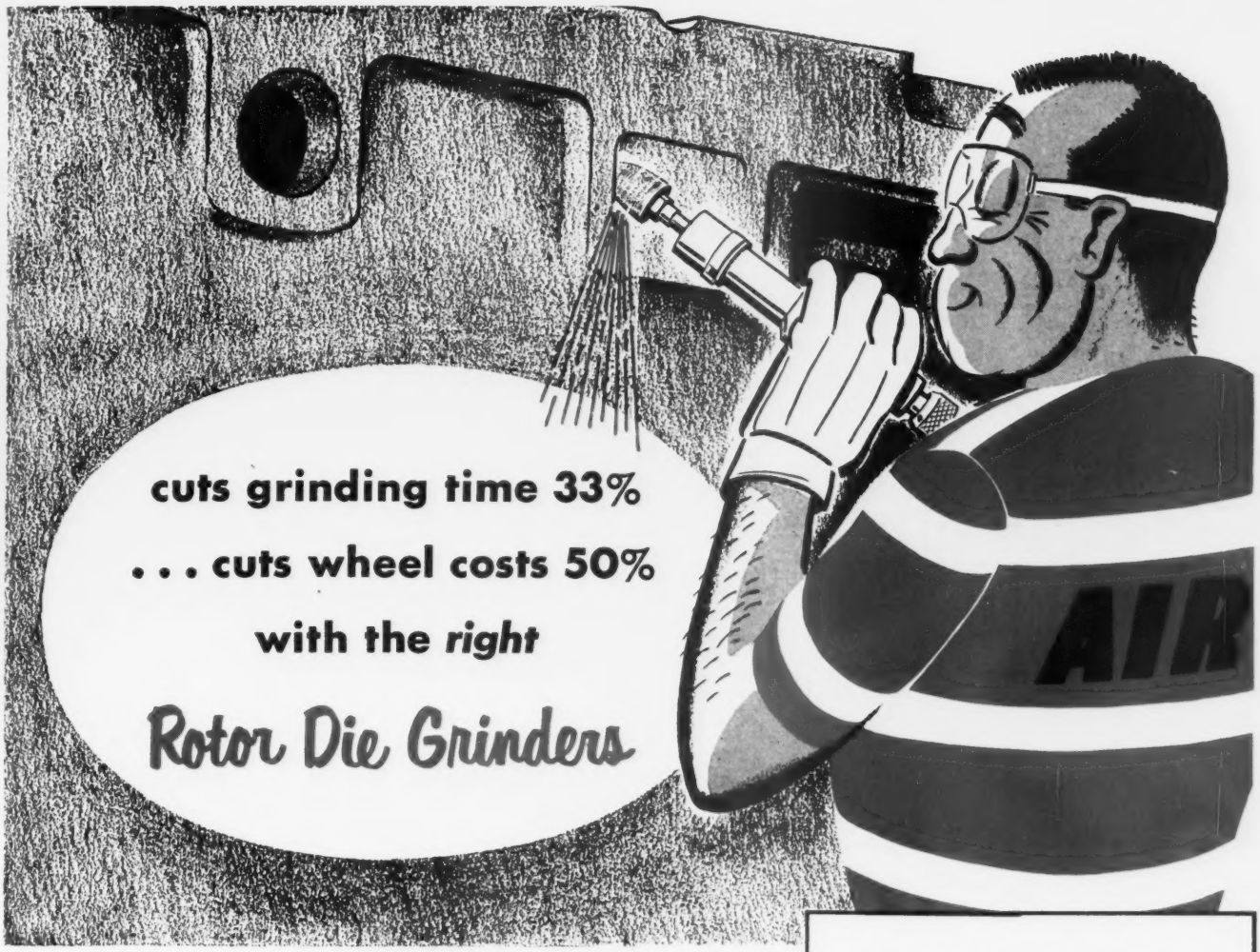
You'll find these compressors stay on the job, operate with sustained high efficiency and require little maintenance. If your plant requires air in volume, it will pay you to investigate the advantages of Fuller Rotary Compressors. A Fuller engineer will discuss them with you.

Fuller

FULLER COMPANY, Catasauqua, Pa.
Chicago 3 • 120 So. LaSalle St.
San Francisco 4 • 420 Chancery Bldg.

DRY MATERIAL CONVEYING SYSTEMS AND COOLERS—
COMPRESSORS AND VACUUM PUMPS—
FEEDERS AND ASSOCIATED EQUIPMENT

C-214



HERE'S how Rotor Tool engineering assistance helped a New England manufacturer of large machine tools:

PROBLEM: Getting into recesses, corners, contours in large machine tool castings of high carbon steel. Finish was important. Used large cone wheels at 6000 R.P.M. Average weight of grinders was 12 to 13 lbs. Hard to control on small contours.

SOLUTION: Rotor Application Engineer recommended Rotor M-871 Short Spindle Die Grinder at 17,000 R.P.M., using small cone wheels. Tool weight is only 4 lbs. 10 oz., permitting faster, easier handling.

RESULTS: High-speed, light-weight Rotor Grinders have cut grinding time 33%. Saves 50% in wheel costs. Cut operator fatigue.

Rotor Application Engineers can demonstrate savings on *your* job. Write for Catalog No. 38.

AIR O'TOOL

281 ROTOR MODELS...

The right grinder for your job!

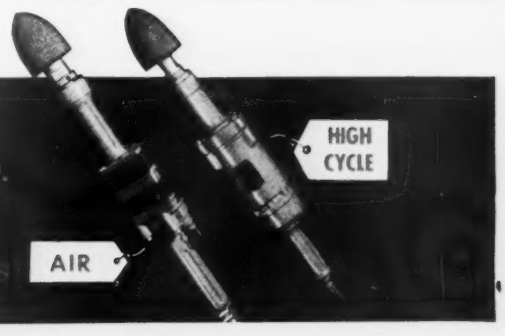
SPEEDS...21,000; 20,000; 17,000; 12,000 and 8,000 R.P.M.

COLLETS...¼"—⅛"—3/16"—½" (for abrasive sticks)

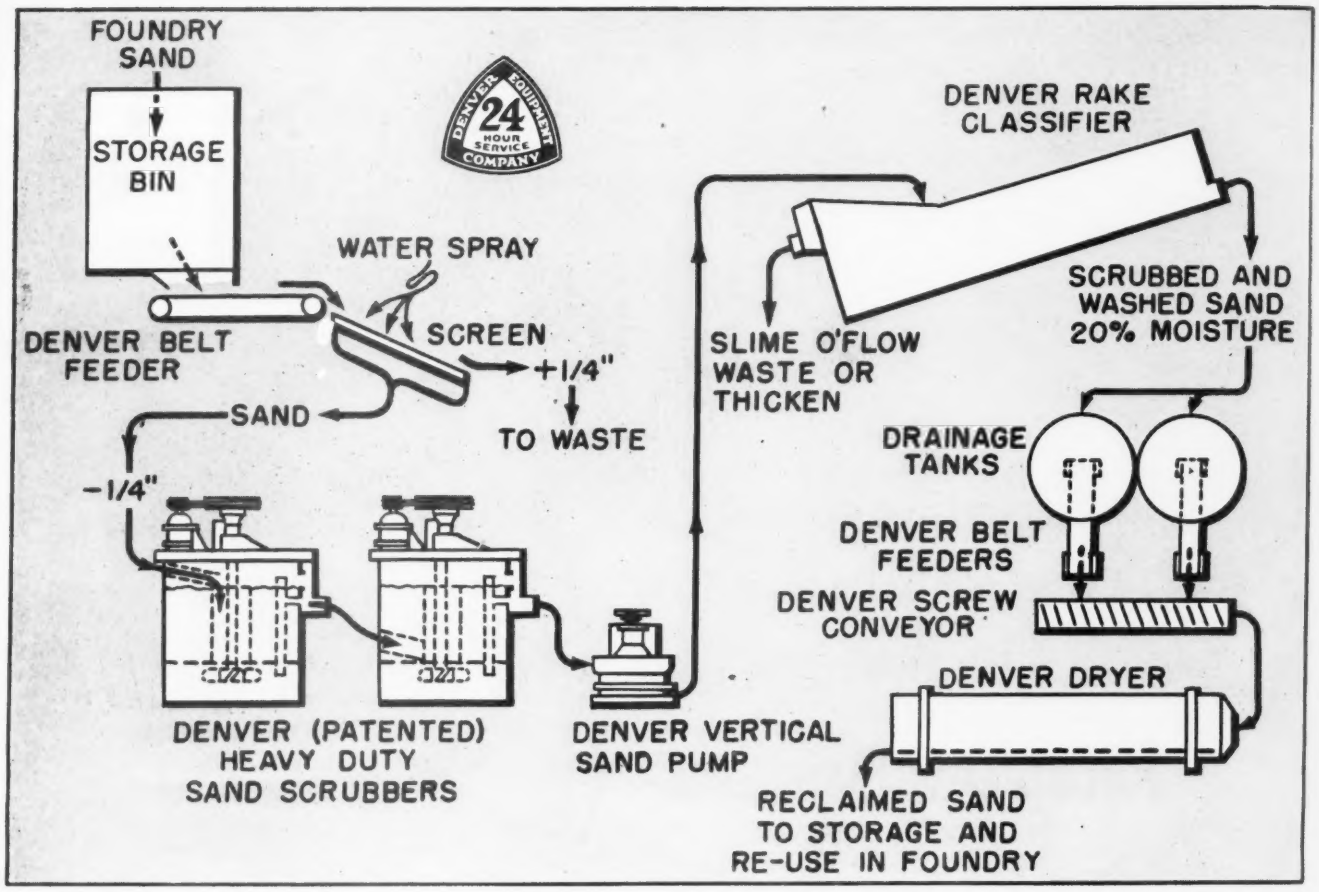
WHEEL ARBORS...For wheels ½" and ⅜" in thickness, cone wheel adapters—also extensions.

SPINDLES . . . Short and long spindles.

HANDLES...Lever, twist, snap and sleeve.



THE ROTOR TOOL CO.
CLEVELAND, OHIO
UNBIASED ANALYSIS OF PORTABLE TOOL PROBLEMS



FLOWSHEET FOR RECLAIMING SAND FOR AS LITTLE AS 75¢ PER TON

This simple method of sand reclamation has 3 definite advantages:

1. *Simplicity of installation and operation.*
2. *Low-cost capital investment and low-cost operation.*
3. *Efficiency of removing spent clays, binders and carbon.*

SIMPLICITY: Equipment is standard, can be located wherever space permits. 3 to 4 ton per hour system as shown above requires space 32′ x 44′ but space need not all be in one location. Continuous operation requires minimum labor. Complete reclamation systems are available from 1 T.P.H. up.

LOW-COST: Equipment required for 3 to 4 ton per hour as illustrated above runs approximately $15,000 (piping and conveying is not included). Motors require a total of 16½ horsepower. Water can be reclaimed for reuse if necessary. Rubber-covered wearing parts give long service. Cost of reclaiming sand runs about 75c to $2 per ton depending on quantity of sand reclaimed. Recovery is normally 80% to 90%.

EFFICIENCY: Scrubbing at high densities (40% water–60% sand) results in attrition of grains striking each other. 30 minutes contact time in Denver (Patented) Heavy Duty Scrubbers is usually sufficient to remove carbons and binders. Patented standpipe prevents short-circuiting. Dewatering and rinsing is done in standard Denver Rake Classifier. Classification also controls percentage of fines in reclaimed product. Drying is done by gravity drainage or by Denver Standard Dryer.

MAKE THIS TEST Small scale laboratory tests on your sand will be made on a cost only basis. Reclaimed sand will be returned to you for complete analysis and test casting. If you are not satisfied with test results there will be no charge. Write for complete details and shipping instructions.

ADDRESS:
Foundry Sand Reclamation Division
Box 5268 • Denver 17, Colorado
Phone CH 4466

Our 25th Year

DENVER EQUIPMENT COMPANY • 1400 17th Street • Denver 17, Colorado

Two Lectromelt Furnaces give Canadian Tube & Steel Products, Ltd. of Montreal laborsaving top charging that spells major economies in metal melting.

He feels an instant response to every demand:
Power supply and regulation equipment were individually engineered, electrode arms counterbalanced, to provide such sensitive and flexible controls.

He gets back into production promptly after every heat:
Top charging with the Moore Rapid Lectromelt Furnace is accomplished quickly and smoothly, as the furnace top lifts and swings on its massive oil bearings. It means many man-hours saved, lower consumption of electrodes and longer lining life. You see the difference in power saved.

He recognizes its added safety:
Side-mounted tilt mechanism prevents jamming and injury of operating equipment by spills and burn throughs.

All these add up to higher quality production, with more tons for fewer dollars. For a free copy of Catalog No. 8 telling you more of this story, write Pittsburgh Lectromelt Furnace Corporation, 314 32nd Street, Pittsburgh 30, Pennsylvania.

Manufactured in . . . CANADA: Lectromelt Furnaces of Canada, Ltd., Toronto 2 . . . ENGLAND: Birlec, Ltd., Birmingham . . . AUSTRALIA: Birlec, Ltd., Sydney . . . FRANCE: Stein et Roubaix, Paris . . . BELGIUM: S. A. Belge Stein et Roubaix, Bressoux-Liege . . . SPAIN: General Electrica Espanola, Bilbao . . . ITALY: Forni Stein, Genoa.

*REG. T. M. U. S. PAT. OFF.

MOORE RAPID

WHEN YOU MELT... *Lectromelt*

DESULFURIZE with SODA ASH

It costs no more to get this Quality Soda Ash . . .

SOLVAY

Trade Mark Reg. U. S. Pat. Off.

DENSE SODA ASH

Especially Designed for Desulfurization

* Medium Grain Size
* Dustless
* High Chemical Purity

Technical Assistance Available—if you have sulfur problems with your grey or malleable iron castings, we invite you to write to SOLVAY's foundry consultant. There is no charge or obligation for this service.

Want More Information on Equipment for Adding Soda Ash?

Efficient, economical, easy-to-operate equipment for feeding Soda Ash into molten iron for desulfurization is now available. We'll be glad to have our foundry consultant supply you with more information if you will give us details of your operation.

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BRANCH SALES OFFICES:
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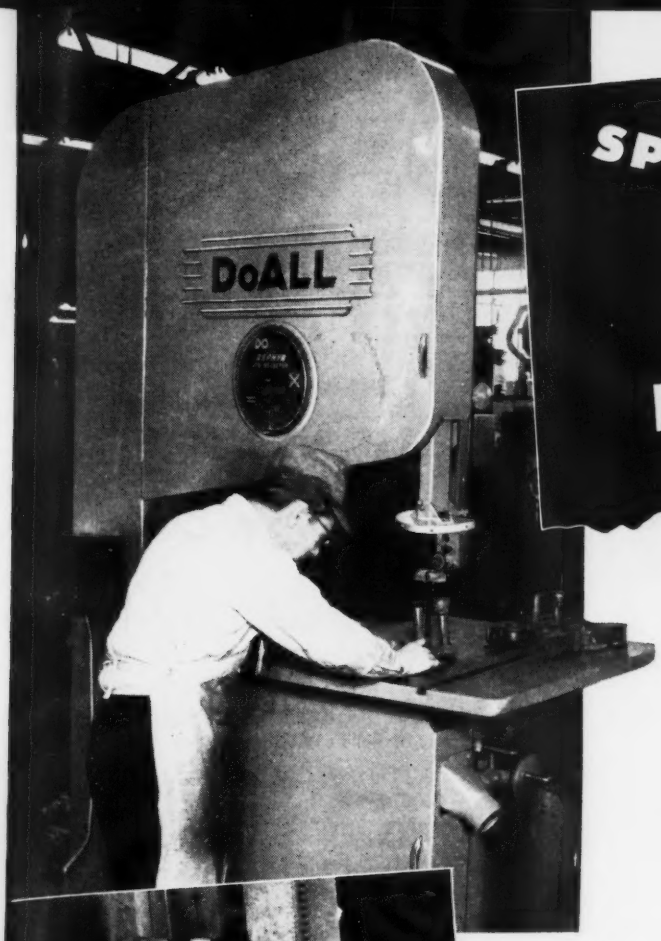


SPEED UP GATE REMOVAL with DoALL FRICTION SAWING!

THE speed of DoALL Zephyr Band Machines for removing gates, risers, flash and other superfluous material from castings will surprise you. DoALL Zephyr Band Machines are fast: they have actually saved as much as 90% in time and tool costs, depending on the thickness of the work. With DoALL you are able to get into complicated spaces and cut *close* to the casting and as finish is generally of high quality, grinding can be either eliminated or materially reduced. The cut is made fast enough so as not to allow heat penetration into the side wall of the finished cut and skin hardness never exceeds .003" deep. Zephyr Friction Sawing means low tool cost and greater tool safety for the operator.

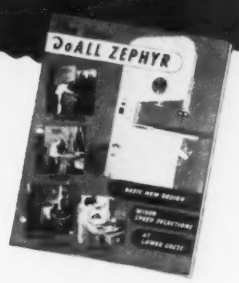
Where extremely fine tolerance and optimum efficiency is desired, automatic hydraulic feeding tables are available. There is a size DoALL Zephyr for every pocketbook and for almost every problem. If you have a special problem we will cooperate with you in tailoring saw design to solve it. Here are advantages you should look into. Ask for a free demonstration in your own plant. Call our local DoALL Sales Service Store or write.

THE DoALL COMPANY, 254 N. Laurel Ave., Des Plaines, Ill.

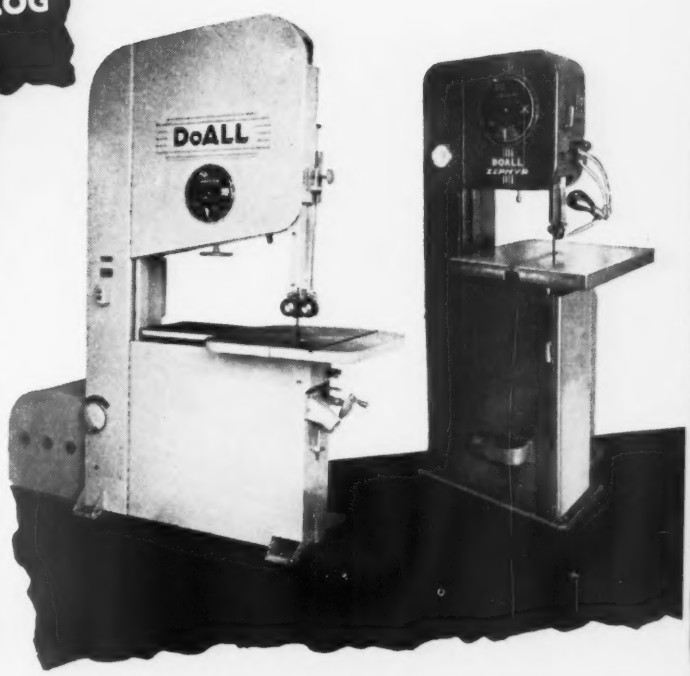
Above: Here is a DoALL Zephyr in a typical installation removing dead metal.

Below: With DoALL Friction Sawing you can cut close to the live metal and reach the hard-to-get-at places.

SEND FOR CATALOG



There is quite a story on costs and speeds in handling castings of various thicknesses. Ask for complete details with a catalog on DoALL Modern Band Machines.



BMF-1

DoALL

CALL DoALL FOR:

Machine Tools . . . Gaging Equipment . . . Tool Steel . . . Band Tools . . . Metal Working Supplies

DELTA *Specialized* FOUNDRY PRODUCTS

FOR FASTER PRODUCTION OF FINER-FINISH CASTINGS *... at lower cost!*

FOR SAND

DELTA Permi-Bond (seacoal replacement)
Sand Conditioning Oils
96-B Sand Release Agent

FOR CORES

DELTA Core & Mold Washes for steel, malleable, gray iron and non-ferrous metals.
Mudding and Patching Compounds
No-Vein Compound
Dri-Bond Binder
Core Rod Dip Oils
Sand Conditioning Oils
Core Oils
Partex
Liquid Parting
Bondite

FOR MOLDS

DELTA Core & Mold Washes for steel, malleable, gray iron and non-ferrous metals.
Partex (Nut Shell Parting)
Liquid Parting
Spray Binders
Bondite

The quality and uniformity of DELTA SPECIALIZED FOUNDRY PRODUCTS are laboratory controlled to insure consistent results in use. Liberal working samples, together with complete instructions for use will be sent to you without cost or obligation. WRITE TODAY.

DELTA OIL PRODUCTS CO.

MANUFACTURERS OF
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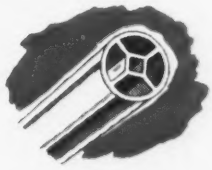
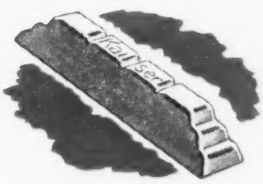
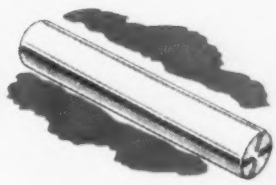
Engineering Assistance and technical

advice on any aluminum casting

or extrusion  problem is yours for the

asking to help you make better use of

Kaiser Aluminum pig, specification

ingot  or extrusion billets 

▶ Aluminum pig, specification ingot, extrusion billets. Sales offices in principal cities. Kaiser Aluminum & Chemical Sales, Inc., Oakland, California.

Kaiser Aluminum

A major producer of aluminum pig, specification ingot and extrusion billets

USCO T

For 48 years, pioneers in aluminum development.

35000 LBS. TENSILE STRENGTH ...WITHOUT HEAT TREATMENT!

USCO T is the high-tensile aluminum alloy that gives you physical properties usually obtainable only by heat treating . . . without this costly extra step.

USCO T can be cast in both sand and permanent mold. Typical properties in sand after two weeks natural aging are 35000 T.S., 25000 Y.S., 5% elongation and 74 Brinell.

For further information on this exceptional aluminum alloy contact your USCO representative now or write us direct.

USCO T is available now for prompt shipment.

FREE—Send for your USCO Aluminum Alloy Selector. A handy guide to analysis, specifications and many other foundry problems.

USCO **U. S. REDUCTION CO.**
East Chicago, Indiana

PLANTS: EAST CHICAGO, INDIANA • TOLEDO, OHIO

PROOF MOLDING SAND FLOWS BETTER, PACKS BETTER

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These unretouched photographs show that Hercules NVX in green sand facing assures foundrymen of firmer, denser molds with high resistance to metal penetration.

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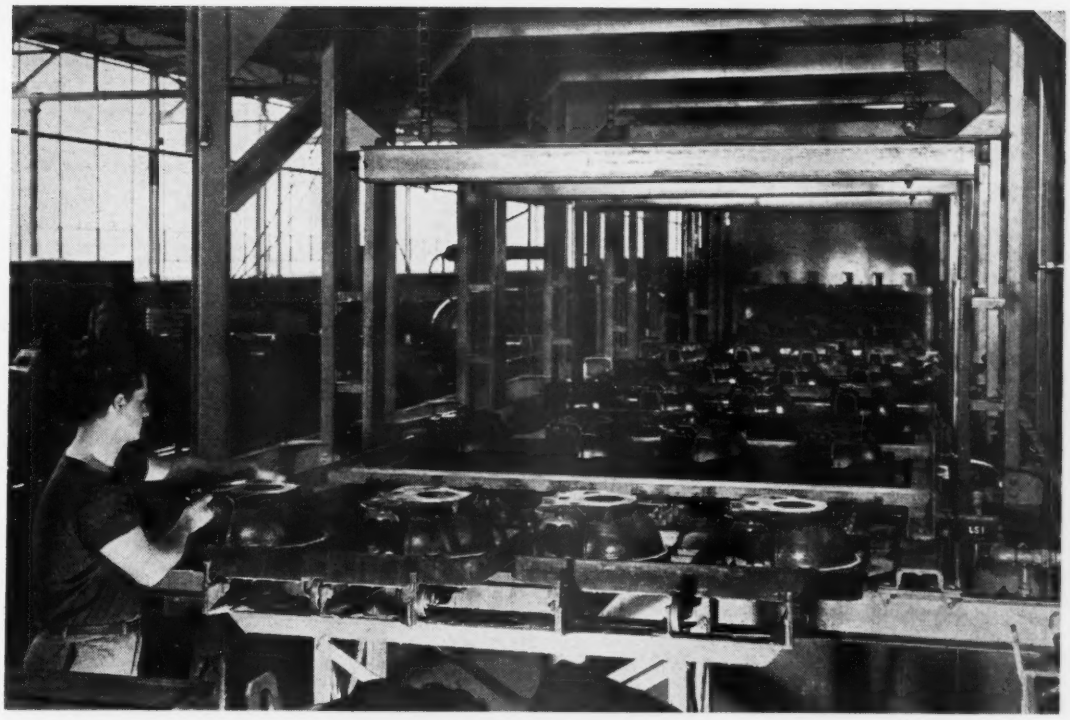

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Here We Go Again!

LATE last fall, and carrying well into 1952, top brass in the Defense Production Authority and the National Production Authority were shouting that shortages of metallics were threatening defense production. Manly Fleischmann, administrator of DPA, was particularly emphatic in stressing the urgency of the scrap problem, and in warning industry of possible furnace shutdowns because of an inadequate supply of scrap metals.

Steel producers, foundrymen, scrap dealers, trade associations, chambers of commerce, the business press and other groups organized to meet the problem. Much time, money and effort was expended by these various groups in getting in the scrap, with what appear to be excellent results. Metalworking plants were able to continue production, even during the winter months when the movement of scrap usually is low.

Success of the drive, plus a slackness in demand for certain types of iron castings, has resulted in some excess in the supply of cast grades of scrap. For example, so many old autos were dismantled during the campaign that the tonnage of scrap cast iron motor blocks available has become heavier than the foundry industry can absorb. Evidently, without considering future needs of our own foundry industry, the NPA recently declared a surplus of unstripped motor blocks, and the Department of Commerce authorized the export of more than 16,500 tons of these blocks for the second quarter. There is every reason to believe that similar action will be taken with other types of scrap that may be considered in excess supply. Furthermore, it is reported consideration is being given in Washington to increasing the exports of pig iron.

If the emergency facing this country is as great as has been painted by our leaders, and if the need for metallics was as urgent as declared by C. E. Wilson, Manly Fleischmann and others, it is criminal to export any surplus of scrap or pig iron. The present softness in demand may be quite temporary.

As an important part of our defense program any excess metallics which may be accumulated should be stockpiled. We do not know how soon we will need every bit of metal that can be found.

Around 1940 this country exported considerable scrap at government direction, and some of us lived to regret it.

Frank G. Steinbach
Editor

AFS IN

I. R. WAGNER
President-elect

COLLINS L. CARTER
Vice President-elect

VARIOUS aspects of the recent AFS International Foundry Congress and Show made it one of the most outstanding and successful of the American Foundrymen's Society's 56 annual meetings. The colorful setting of Atlantic City, where the foundrymen convened May 1-7; the international flavor given by the presence of some 225 visitors from more than 30 foreign countries; a spectacular display of new and improved equipment and supplies, and a technical program replete with informative data of both a practical and theoretical nature—all combined to capture the attention and interest of the convention's approximately 13,000 visitors.

Thirty-seven years ago the society last met in Atlantic City and attracted the then record total of 722 members and guests. While this year's attendance is one measure of the foundry industry's growth since 1915, the congress and show demonstrated that technological progress in castings practice and facilities has been at least equally marked during the period.

AFS officers and delegates from abroad participated in a ceremony opening the congress, May 1, at Convention Hall, where most of the week's events were centered. Presiding was Chester V. Nass, Beardsley & Piper Division of Pettibone Mulliken Corp., Chicago, who, as president of the National Castings Council, served as general chairman of the congress committees. After welcoming the visitors, Mr. Nass called on Tom Makemson, secretary, Institute of British Foundrymen, and honorary secretary, International Committee of Foundry Technical Associations, to introduce the overseas delegates. Response to the welcome was given by Dr. Marcel Ballay of France, who spoke in behalf of all the foreign

Robert Crignier, Congress delegate from Belgium speaks for overseas guests at AFS annual meeting

John S. Bugas, vice president of Ford Motor Co., delivering the Charles Edgar Hoyt Annual Lecture

...videnced at

...INTERNATIONAL CONGRESS

member nations of the committee. Greetings to the visitors also were extended by AFS President Walter L. Seelbach, Superior Foundry Inc., Cleveland.

International Committee—Annual meeting of the International Committee of Foundry Technical Associations was held at Atlantic City, May 4, and was attended by official delegates from Belgium, Denmark, France, Great Britain, Germany, Italy, India, the Netherlands, Norway, Sweden, Switzerland and the United States. Owing to the death last March of Guido Vanzetti, president of the International Committee, the chair was occupied by Vice President L. N. Shannon, Stockham Valves & Fittings Inc., Birmingham.

An application for membership from Associacao Brasileira de Metals, metal association of Brazil, was considered and was accepted on condition that the Brazilian association should organize a foundry section with its own president and officers. Tom Makemson, honorary secretary, presented the reports of the International Committee on Testing Cast Iron, the International Committee on Foundry Defects and the International Dictionary Committee. These reports were approved, and the delegates representing the member associations agreed to continue their collaboration in the work being done by these three committees.

The Association Technique de Fonderie, of France, was formally invited to submit the name of a recipient

(Right)—Walter L. Seelbach gives the president's annual address at the society's business meeting

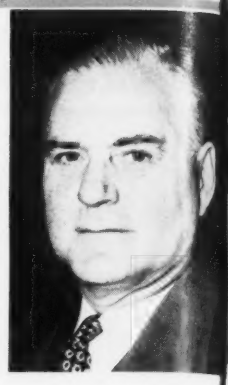
(Below)—Part of the overflow audience attracted to the symposium held on the subject of shell molding

J. O. KLEIN

A. D. MATHESON

H. G. ROBERTSON

W. J. KLAYER



M. A. FLADOES

AFS medalists. Left to right, standing: Keith D. Millis; Dr. Marcel Ballay, who accepted the Joseph S. Seaman Medal for Albert Portevin of France in the latter's absence; Ralph J. Teetor, chairman of the AFS Board of Awards, and Frank G. Steinebach. Seated: Henton Morrogh, England; Albert P. Gagnebin

for the Award of Honor of the Internatoinal Committee in 1953.

The program of International Congresses from 1953 to 1955 was reviewed. The 1953 Congress will be in France, that for 1954 in Italy and that for 1955 in Great Britain. Prof. Ove Hoff, delegate from Denmark, proposed that 1956 be tentatively reserved for a congress in Scandinavia. This proposal was unanimously accepted, subject to confirmation prior to the next meeting of the committee.

Election of committee officers for the coming year resulted in naming Mr. Shannon to the presidency. For vice president France was invited to nominate a member of its association. Tom Makemson was re-elected honorary secretary by acclamation.

AFS Business Meeting—Annual meeting of the society, presided over by President Seelbach, was exceptionally well attended. In his annual address the president reported a society membership of approximately 10,000—95 per cent of whom are affiliated with the 54 chapters. He praised the work of the 600 members serving on AFS technical committees whose voluntary activities he declared would be too valuable for any corporation to afford. Mr. Seelbach discussed the various AFS-sponsored research projects and urged support of the 10-year, $350,000 safety, hygiene and air pollution program launched recently. He also announced that the society is proceeding with plans for its new headquarters building of 9000 square foot floor area to be erected in the Chicago area.

In the absence of additional nominations, secretary-treasurer William W. Maloney announced the election of officers and directors nominated previously by the AFS Nominating Committee for 1952-53, to take office this summer. I. R. Wagner, Electric Steel Castings Co., Indianapolis, and currently vice president, will succeed Mr. Seelbach. Collins L. Carter, president, Albion Malleable Iron Co., Albion, Mich., was elected vice president. Directors elected for three years are:

Martin A. Fladoes, Sivyer Steel Castings Co., Milwaukee; Walter J. Klayer, Aluminum Industries Inc.,

(Above)—Speaking at the annual AFS business meeting, William W. Maloney, secretary-treasurer, announces election of new officers and the five new directors shown at top, opposite page

(Left) — President Seelbach presenting awards to the winners in the 1952 AFS apprentice contest: Robert P. Schmidt, Henry C. Grube, Fernand Lemieux, David L. Schroeder and Luther R. Hardin

(Below)—AFS officials and foreign delegates participating in the ceremony opening the International Foundry Congress

Topping all records for attendance at an AFS annual banquet, 1175 were present for the 1952 International Banquet in Atlantic City's Convention Hall ballroom

Cincinnati; J. O. Klein, Texas Foundries Inc., Lufkin, Tex.; A. D. Matheson, French & Hecht Division, Kelsey-Hayes Wheel Co., Davenport, Iowa; H. G. Robertson, American Steel Foundries, Alliance, O. Mr. Seelbach will serve a one-year directorship.

Speaking briefly on the work of the AFS Education Division, of which he is chairman, George J. Barker, University of Wisconsin, praised the efforts of the Apprentice Contest Committee's chairman, Roy Schroeder, University of Illinois, and its secretary, Joseph E. Foster of AFS headquarters. Mr. Maloney announced results of the 1952 contest in which 268 apprentices from 94 companies participated. Prior to the national judging local contests were conducted by ten chapters and ten individual plants. National winners, who were present to receive their cash prizes and certificates from Mr. Seelbach, were:

Gray iron molding—Robert P. Schmidt, Brown & Sharpe Mfg. Co., Providence, R. I. Steel molding—Henry C. Grube, Waukesha Foundry Co., Waukesha, Wis. Nonferrous molding—Fernand Lemieux, Dominion Engineering Works Ltd., Lachine, Quebec. Wood patternmaking—David L. Schroeder, Universal Foundry Co., Oshkosh, Wis. Metal patternmaking, Luther R. Hardin, Ford Motor Co., Dearborn, Mich.

Speaking for all overseas delegates at the annual meeting, Robert Crignier of Belgium declared that the 1952 congress would be a landmark in the foundry industry's history. He expressed appreciation for the technical knowledge acquired through the co-operation of American foundrymen, assistance which will be invaluable in helping to solve problems abroad. Mr. Crignier's remarks were translated by Vincent Delport, European manager, FOUNDRY.

Immediately following the business meeting John S. Bugas, vice president-industrial relations, Ford Motor Co., delivered the Charles Edgar Hoyt Annual Lecture. In an inspiring address, "Industry's Responsibility to Youth," Mr. Bugas emphasized that the way to strengthen the faith among young people in the superiority of the American way of life is not simply by words, but by deeds. These deeds include keeping open the doors of opportunity; providing conditions in which youth of today and the men of tomorrow can move forward toward ever better things, and setting an example of good citizenship.

International Banquet — The largest number of guests at an annual AFS banquet, 1175, attended the colorful International Banquet Saturday evening. High light of the event was the presentation of annual AFS awards. Ralph J. Teetor, Cadillac, Mich., past national president and Board of Awards chairman, presented the Joseph S. Seaman Medal, awarded to Albert Portevin, Paris, France, and accepted in the

latter's absence by Dr. Marcel Ballay; the John A. Penton Medal to Frank G. Steinebach, editor, FOUNDRY; the William H. McFadden Medal to Henton Morrogh, research manager, British Cast Iron Research Association; the Peter L. Simpson Memorial Medal jointly to Albert P. Gagnebin and Keith D. Milles, International Nickel Co., New York.

Honorary life memberships in AFS were awarded William G. Mixer, Pontiac, Mich., Alexander I. Krynitsky, Chevy Chase, Md., and Retiring President Seelbach.

L. N. Shannon, vice president, International Committee of Foundry Technical Associations, announced that the committee had selected the late Carlo Vanzetti of Italy, one of the original organizers of the international group, to receive its Award of Honor, a bronze replica of Cellini's Perseus. The award, instituted last year by Comm. Mario Olivo of Italy, was accepted by Dr. Eugenio Mortara. In a gesture of friendship to American foundrymen, another replica of the figure was presented for permanent installation in AFS headquarters.

In his remarks concerning the success of the congress, President Seelbach announced that the 1953 annual AFS meeting would be held in Chicago, May 4-8. Marking a departure from past banquets the evening was concluded with a highly enjoyable entertainment program.

Following a well established custom Canadian foundrymen held their annual dinner meeting Sunday evening. The group of about 250 included several American and foreign guests. Under the expert chairmanship of J. J. McFadyen, Galt, Ont., the dinner was followed by an interesting impromptu program of brief remarks, short stories and recognition of prominent personages in the audience.

More than 300 attended the annual Alumni dinner Monday evening to hear William J. Grede, president, Grede Foundries Inc., Milwaukee, and president, National Association of Manufacturers discuss "Our Free Enterprise." Walton L. Woody, vice president, National Malleable & Steel Castings Co., Cleveland, and immediate past president of the society, presided at the dinner, which broke (*Please turn to page* 148)

FOUNDRY SHOW

Demonstrates Broader Equ

THE 1952 Foundry Show held May 1-7 at Atlantic City under sponsorship of the American Foundrymen's Society, was one of the best. Practically all materials and machines employed in the casting of metals were on display on one floor, with the total floor space used approaching the record for previous shows. Exhibitors were pleased with the quality of attendance and with the results accomplished. Appearance of the show was striking, as is shown in the accompanying illustrations.

Because of their size, a number of exhibits stood out. These included a complete molding, shakeout, sand preparation system in operation; a large tower type core oven; several displays of large cleaning equipment; a number of exhibits of core blowers, molding machines and dust arresters, and the equipment displayed on the huge stage. Metal was melted in two booths, one exhibitor using a small electric furnace, the other a 4-in. cupola.

Studying the show and listening to comments of visitors, it would seem that the trends developed at Atlantic City pertained to the rapid utilization of automatic and semi-automatic operation on foundry equipment which reduces the need for skilled workers; the progress that the chemical industry has made in the foundry industry the last few years, and the greater attention the equipment industry is giving to machines for the smaller foundries.

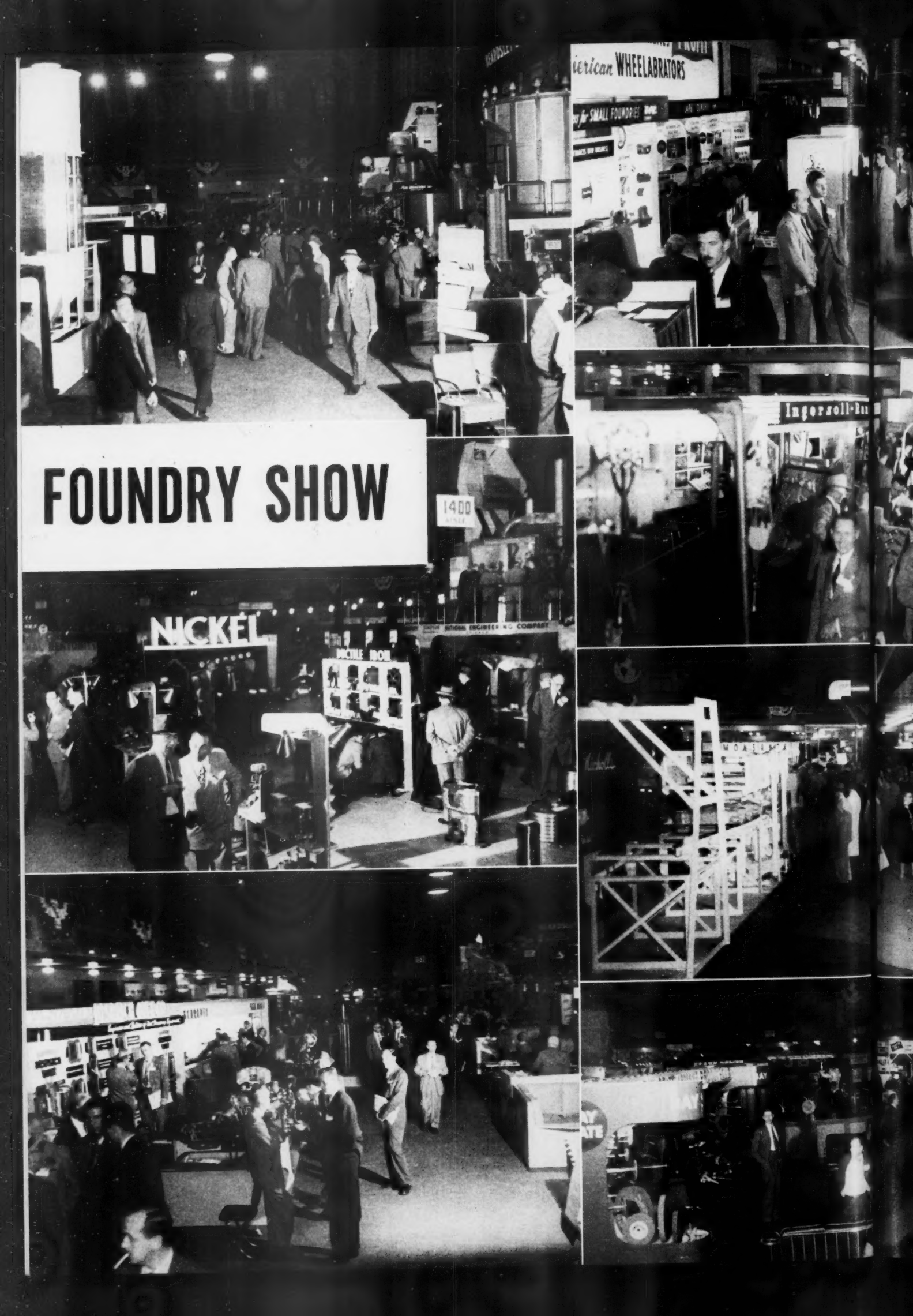
Movement toward pushbutton control was especially well demonstrated in molding machines that operate automatically according to predetermined standards and time cycles, from the empty flask on a conveyor to the finished mold on a conveyor; coremaking machines that perform all operations from blow to draw in sequence, and the various types of equipment designed to provide these and other controls.

The chemical industry, showing two years of progress in the field of shell molding, attracted great interest at their exhibits. One feature was the finished appearance of the shell molding machines used in various demonstrations, as contrasted to the rather crude methods of making molds shown two years ago at Cleveland.

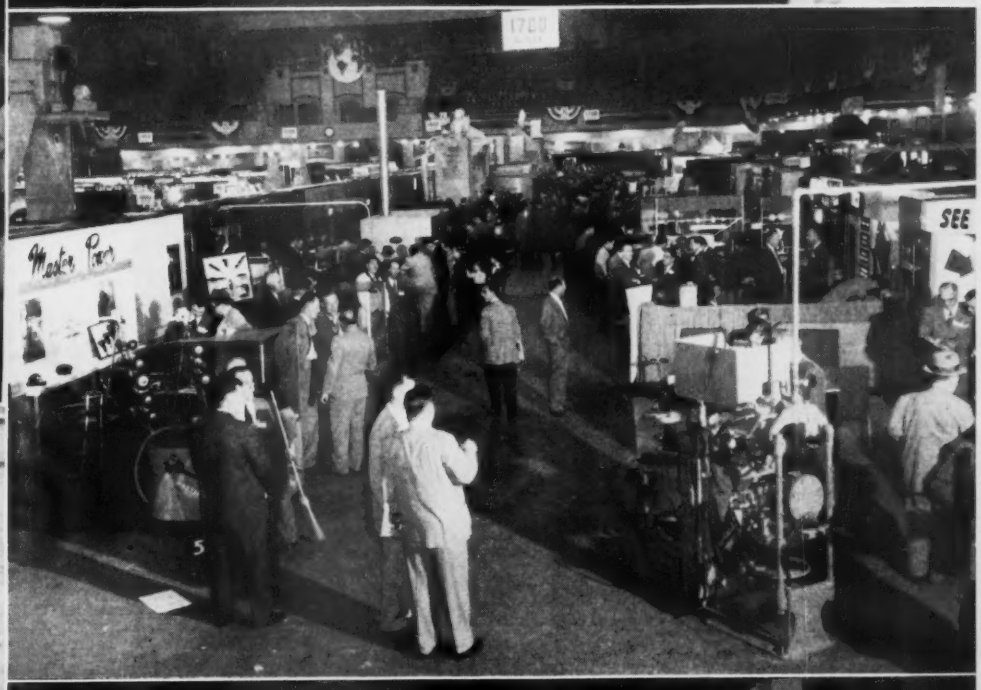
Development of more equipment for the smaller foundries, covering the complete cycle of castings operations, was evident at a number of displays. This should help these shops, which constitute the greatest number of foundries in the country, to meet manpower and cost problems.

r Equipment Use

High lights of the displays at Atlantic City included adaptation of additional equipment to use by smaller shops, more automatic operation of foundry machinery, and progress in development of materials and facilities for shell mold production



FOUNDRY SHOW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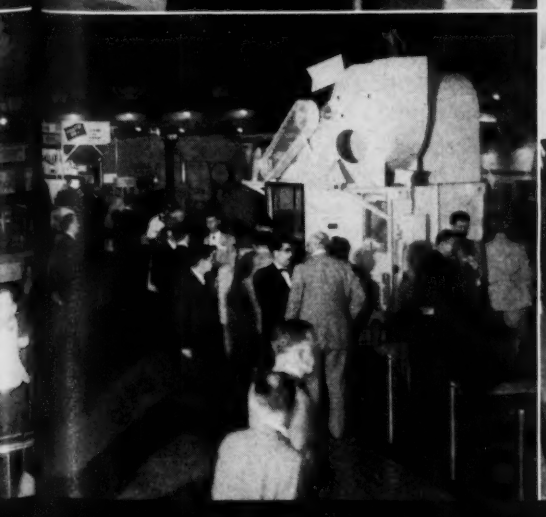


The Shell Molding Process

—its mechanics and applications

By BERNARD N. AMES,
SEYMOUR B. DONNER and NOAH A. KAHN
Metallurgy Branch, Materials Laboratory
New York Naval Shipyard, Brooklyn, N. Y.

THE METHOD of sand mold construction has varied little, basically, since the origin of the foundry art. There have been technological advances in the types and grading of base sands and binders utilized and in the amount of temper water required, which have resulted in improved casting quality. However, sources of hydrogen in molding mixtures, particularly temper water, have been and are still prime origins of difficulty in the founding of quality castings.

This paper presents the results of one phase of an investigation sponsored by the Bureau of Ships, Navy Department, at the Material Laboratory, New York Naval Shipyard, to develop molding and core materials which will represent an improvement over the presently utilized types and will tend to minimize some of the difficulties noted above. This phase of the above project involves the utilization of thermosetting plastics as sand binders which require no temper moisture or additional bond materials for mold construction. This technique had been named the shell molding process.

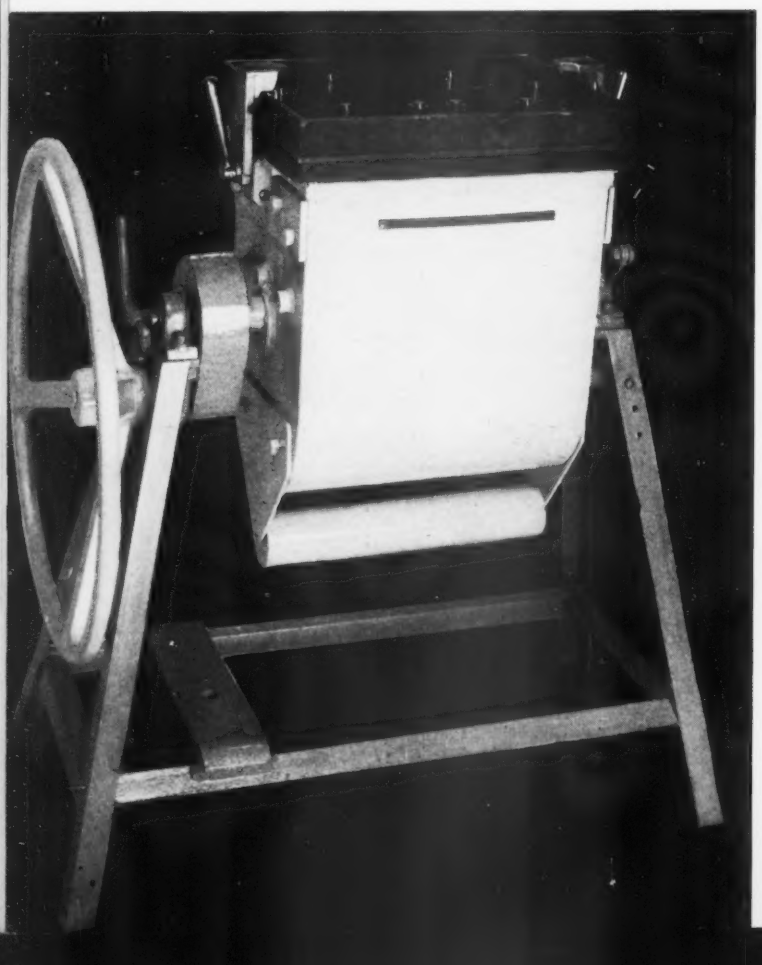


Fig. 1—Rollover machine, 14 x 18-in. plate size, for depositing resin-sand mixture on the pattern

Introduction—The shell molding process can be considered one of the major, recent technological advancements in the foundry industry. The process received its impetus in this country from a sparse description[1] of the technique in an OTS Report, Fiat No. 1168, prepared by William W. McCulloch and dated May 30, 1947. The method described in the Fiat report was utilized by Johannes Croning primarily for the production of fittings cast in the light metal and ferrous alloys at the Hamburg, Germany plant of Croning & Co. Subsequent development work in this country has made this process a useful and economic tool geared to the requirements of the foundry industry.

Recent literature — which represents, so far as known—the only additional technical material published in this country, includes: (a) articles by Ames, Donner and Kahn[2,3,4] which described the results of development work in the shell molding process; (b) an article by Less[5] which covers basic techniques developed by the author in the laboratory with which he is associated; (c) a publication by Czygan[6] which describes the design characteristics and cyclic performance of a production machine for the manufacture of shell molds; (d) a paper based on a talk by Geisler[7] before an American Foundrymen's Society Ohio Regional Foundry Conference, which deals with shell molding; (e) a report of an investigation by Dow Chemical Co.[8] on the application of shell molding to the casting of magnesium-base alloys; (f) an appraisal of the shell molding method generally, by Roast[9] and (g) a description by Calder[10] of a shell molding system as conducted by a jobbing foundry.

Mechanics of the Process—Basically, the shell molding method utilizes the thermosetting properties of phenolic resins to provide a bond material for silica grains in the construction of a mold. The use of urea and phenolic resins is by no means novel in the production of sand cores and molds. However,

Fig. 2—14 x 18-in. pattern plates used to make molds for a mounting panel casting

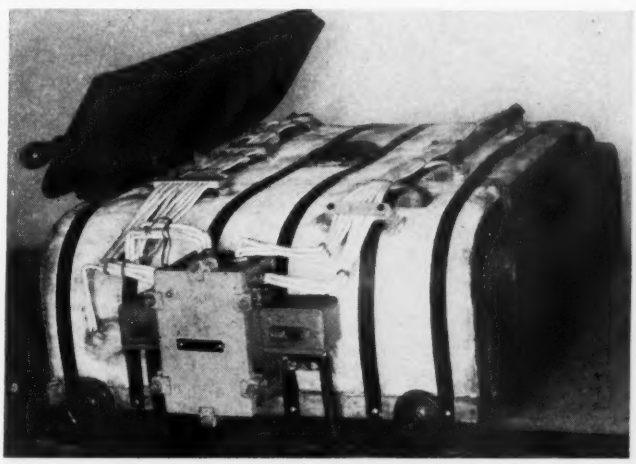


Fig. 3—Electric strip heater mold curing oven. One minute at 600°F generally effects a cure

Fig. 4—Stripping cured mold half from pattern. This is the plate shown at the left in Fig. 2

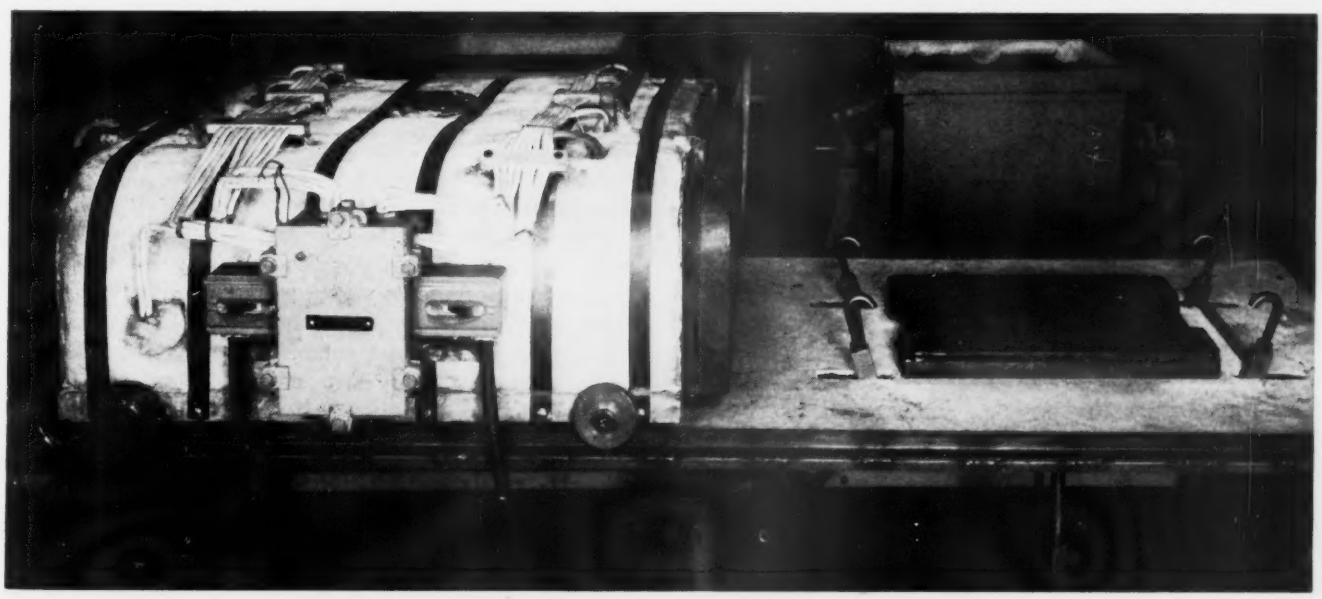


Fig. 5—Arrangement of molding, curing and mold stripping equipment

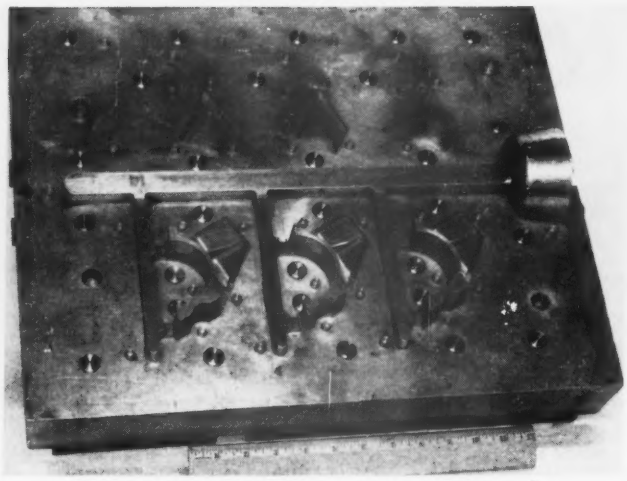


Fig. 6—Pattern plate for motor bracket mold

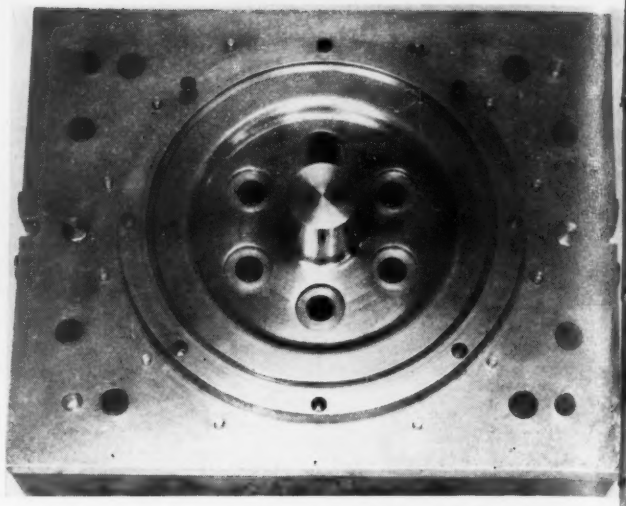


Fig. 7—Pattern plate for 12-in. diam sheave

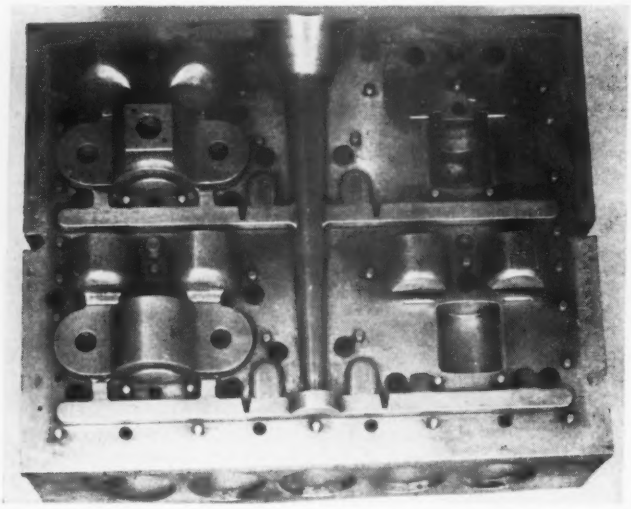


Fig. 10—Showing gating and heading arrangement in pattern employed to cast iron staging clamps

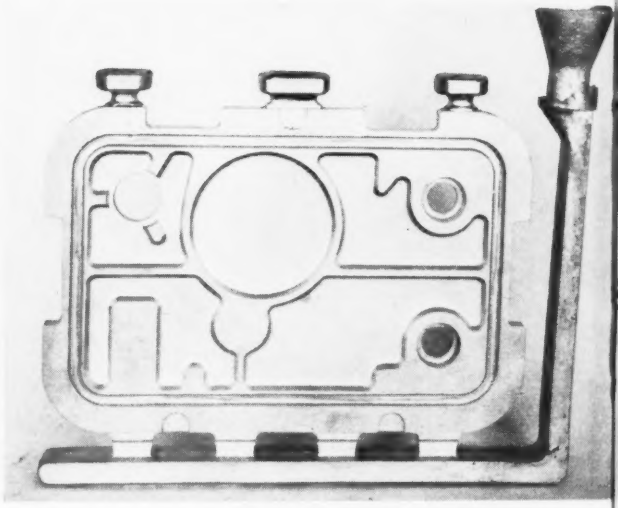


Fig. 11—Cast aluminum mounting panel, as cast. Panel was held to .010-in. on overall length

shell molding techniques are unique in that neither temper water nor additional bond materials are employed.

The most suitable sands for this process appear to be washed silica sands ranging in AFS fineness from 75-230, either of sub-angular or round grain shape. The clay content should be under 3 per cent and the sand should be low in metallic oxides or fluxing agents. Sands with a wide distribution (five or six screens) seem to yield superior finishes, as compared with three-screen sands. As a general rule, the finer the sand, the smoother the resultant surface of the casting. Zircon sands are satisfactory in performance, but their comparatively high cost may make their use impractical except for special applications. Additive materials such as silica or zircon flours, in approximately 10 per cent additions, yield improved surface finishes, particularly with high melting point alloys.

The amount of resin employed will vary from 5-9 per cent by weight of the sand utilized. Resins are of the phenol-formaldehyde class and may be either of a single or two-step type. In the former case, the necessary excess of formaldehyde to complete the reaction is contained in the formulation and in the latter case an accelerating material is added, usually hexamethylenetetramine. Approximately 10-15 per cent of the "hexa" is employed. The two-step resins are being utilized almost exclusively since they possess better storage characteristics and shelf life.

Based on the results of a series of resin evaluation tests conducted by the authors, the most satisfactory resins for molds are those with low to moderate flow characteristics, high melting points, and fast cure rates. The most important variables affecting resin suitability are flow, cure, melt viscosity and melting point. The manufacture of cores may require a resin of slightly different characteristics than that employed for molds, depending on the shape of the core. This applies whether the core is made by the "blowing" or "dumping" technique. Usually cores with sharp radii will require a resin with longer flow characteristics.

The moldmaking operation is essentially a me-

Fig. 8—12-in. diam wire rope sheave, as cast

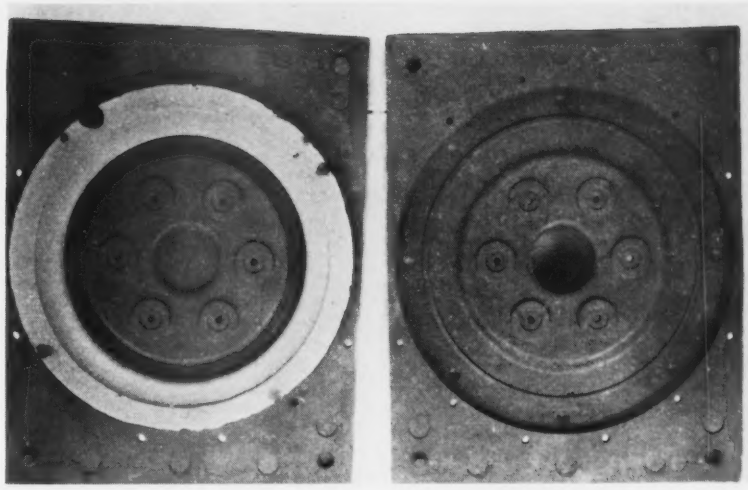


Fig. 9—Sheave mold halves, with zircon core

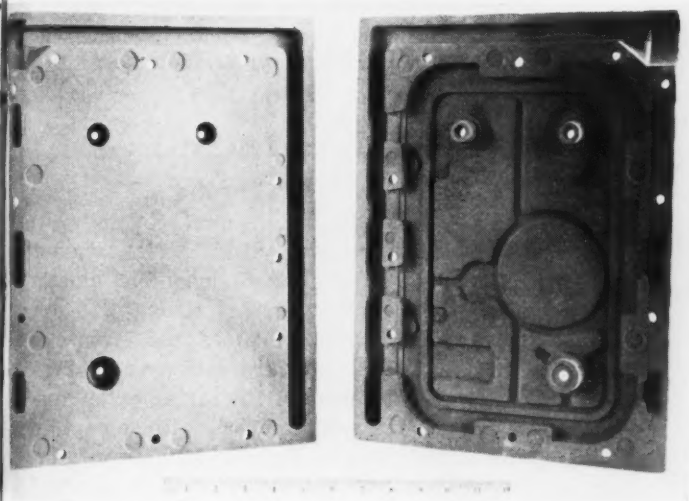


Fig. 12—Cope and drag for mounting panel mold. These halves made from patterns shown in Fig. 2

Fig. 13—Mold for mounting panel casting assembled by bolting, one of several methods to close halves

chanical one and is neither involved or difficult, requiring less than two minutes per cycle. Metal half patterns and attached runners and gates are used, and are mounted accurately on metal pattern plates as shown in Fig. 2 in much the same manner as in long-run molding machine practice. A set of beveled bosses on one plate and a corresponding set of cavities on the other make for accurate registration in assembling mold halves, and practically eliminates any shifts.

The pattern assembly is brought to a suitable temperature for forming the mold (approximately 350-500° F) in a heating unit or with heating elements. It is then sprayed with or dipped in a mold release agent (generally a silicone water emulsion, 2-5 per cent by volume) and positioned pattern down, as illustrated in Fig. 1, over a box containing the loose molding material. This investment is prepared by mulling the sand-resin mixture in a conventional foundry muller for a period of about seven minutes. The "dump-box" is then inverted quickly, which causes the investment to fall and envelop the pattern and plate. The

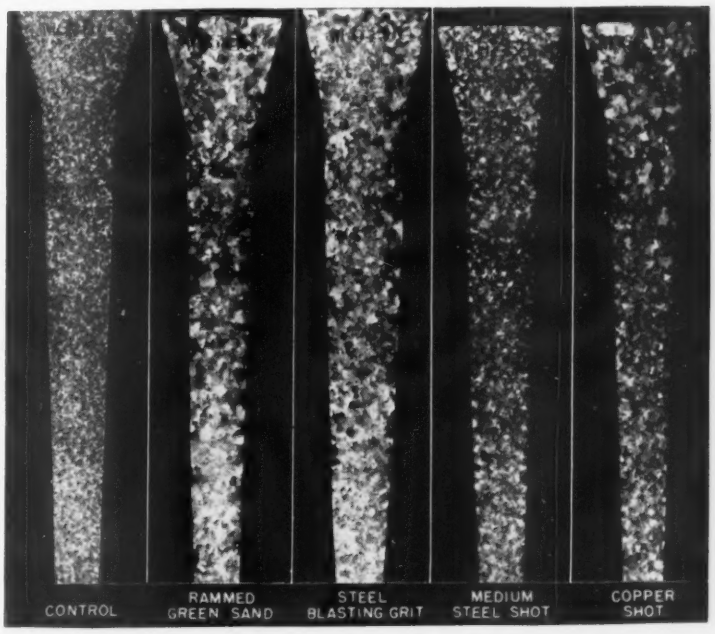


Fig. 14—Effect of varying back-up material on the macrostructure of shell-cast "G" bronze test plates

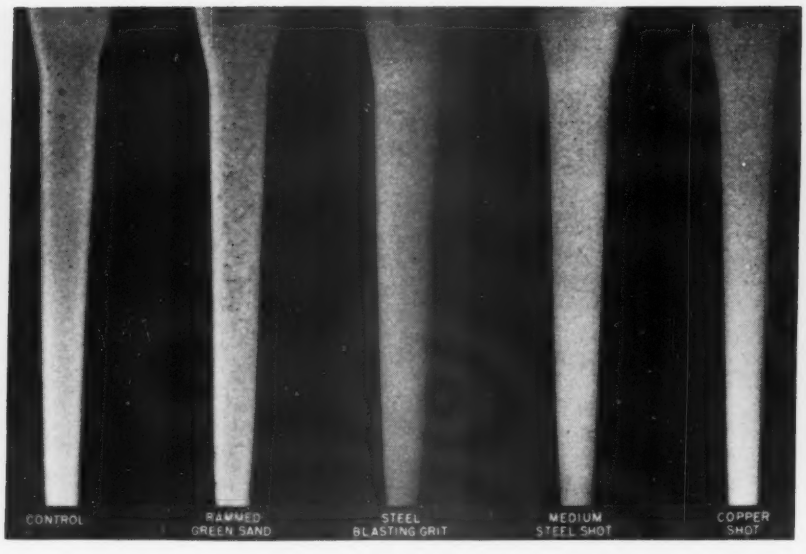


Fig. 15—Exographs of thin slices to show the effect of different types of back-up material on soundness of shell-cast "G" bronze plates

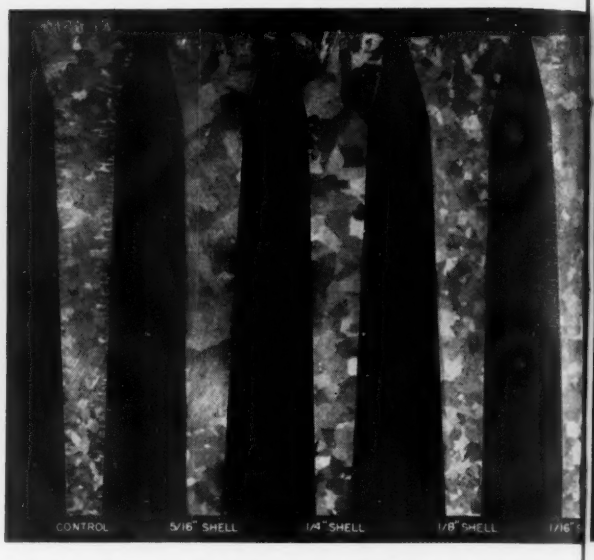


Fig. 16—Illustrating how the thickness of the mold affects the macrostructure of "G" bronze. Control test plate was cast in green sand mold

resinous binder material softens under the influence of the heat of the plate, and adjusts itself closely to the outline of the pattern, building up a uniform coating as the heat penetrates the mass. After a 6-15 second "dwell" period, depending on the practice employed, the pattern plate with the coating of set but uncured investment is removed from the dump box and is ready for the curing operation.

The plate and adhering coating are then placed in a heating unit for curing or may be cured with heating elements under the pattern plate. An electric strip heater unit utilized by the authors in the conduct of this investigation, and at the New York Naval Shipyard foundry for production purposes, is illustrated in Fig. 3. For curing, one minute at 600°F is generally sufficient. At higher or lower temperatures the curing cycle is correspondingly shorter or longer.

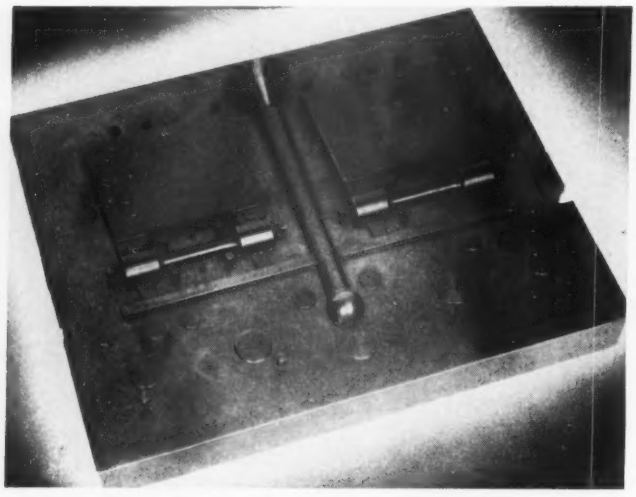


Fig. 17—Bronze test bar pattern plate, 14 x 18 in.

During curing, the resin component in the investment material is converted into a hard, insoluble plastic which holds the silica grains together strongly.

After curing, the half molds are stripped from the plate with the aid of spring-return stripping pins as shown in Fig. 4. The location of the strip heater unit with respect to the stripping unit and the complete molding unit is illustrated in Fig. 5. Molds are generally bedded with a back-up material such as steel shot, for casting. Cores can be produced with a cycle similar to that employed for molds, the investment generally being blown or dumped into a heated core-box, with the excess mold material being slushed out to provide a thin, hollow core.

Investment Mixing — A conventional type sand muller with the wheels raised approximately 1 in. is most satisfactory for blending the resin-sand mixture. The pan temperature should not reach the point where the resin will flow excessively and start curing prematurely. Generally, about seven minutes is sufficient time for mulling although additional time may be necessary if the resin is lumped.

The muller should be provided with a hood to prevent dusting in the surrounding area. In that regard, wetting agents are frequently employed to minimize dusting and to lessen the tendency for resin segregation. Kerosene in 0.25 per cent weight additions is commonly used for this purpose.

Various methods are currently being explored in an effort to reduce the percentage of resin required. One such technique which shows promise involves coating each sand grain with a polar compound prior to mulling the resin-sand mixture.

Pattern Equipment—The pattern and plate materials used principally, to date, are of alloy cast iron, the so-called "non-shrink" steels, and a heat-treatable copper-nickel-silicon alloy. (*Please turn to page* 287)

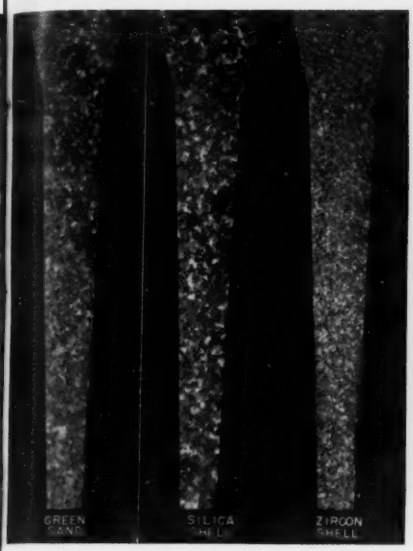


Fig. 18—Effect of base sand on macrostructure of shell-cast 43 aluminum alloy plates

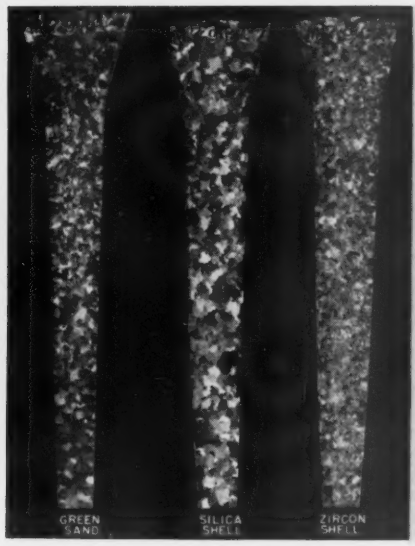


Fig. 19—Effect of base sand on macrostructure of shell-cast "G" bronze test plates

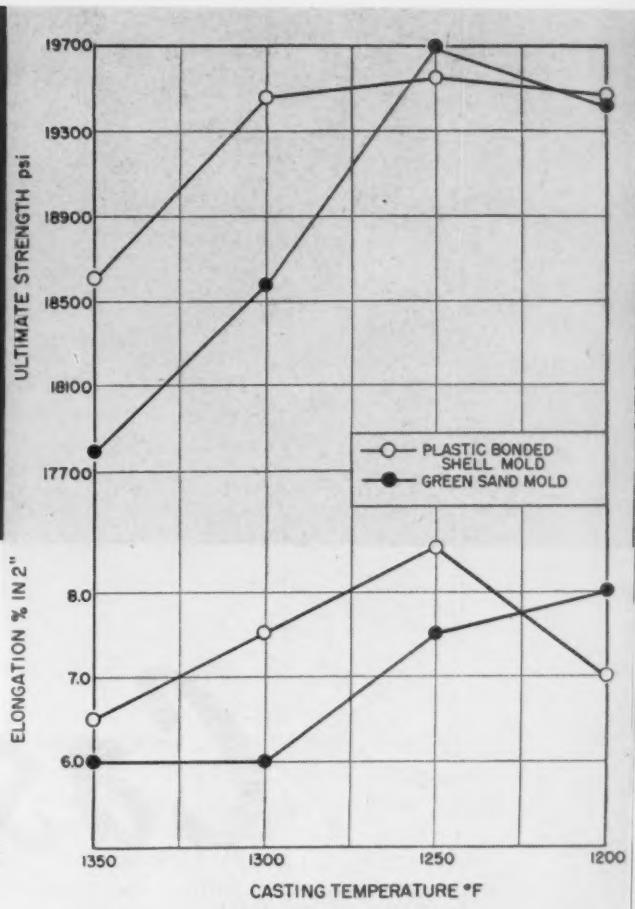


Fig. 20—Mechanical properties vs. pour temperature of 43 aluminum alloy, shell cast and green sand cast bars

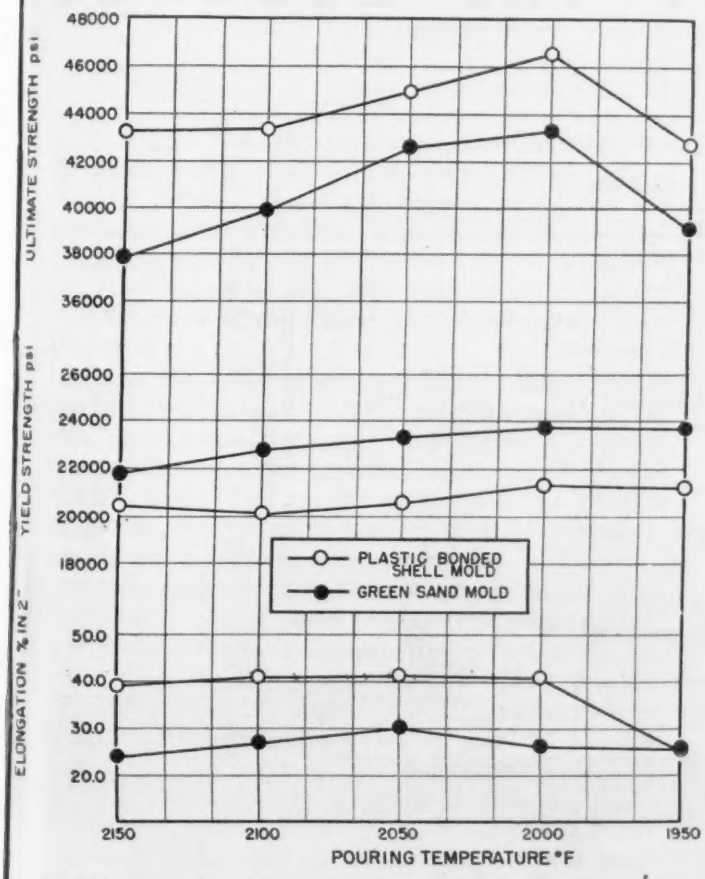


Fig. 21—Mechanical properties vs. pour temperature, navy "M" bronze, as-cast gage shell and green sand cast bars

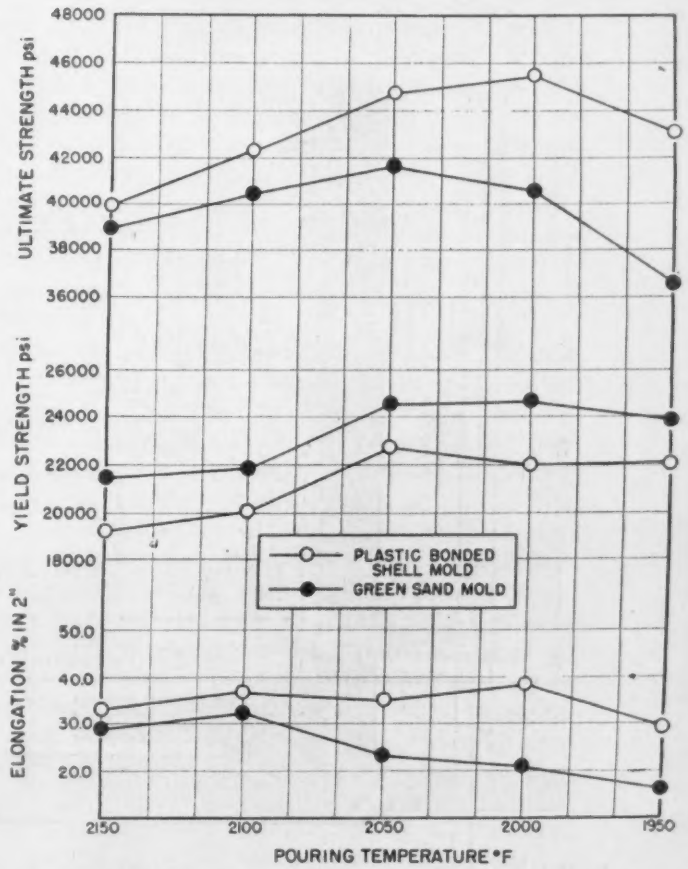


Fig. 22—Mechanical properties vs. pour temperature of "M" bronze, machined gage shell and green sand cast bars

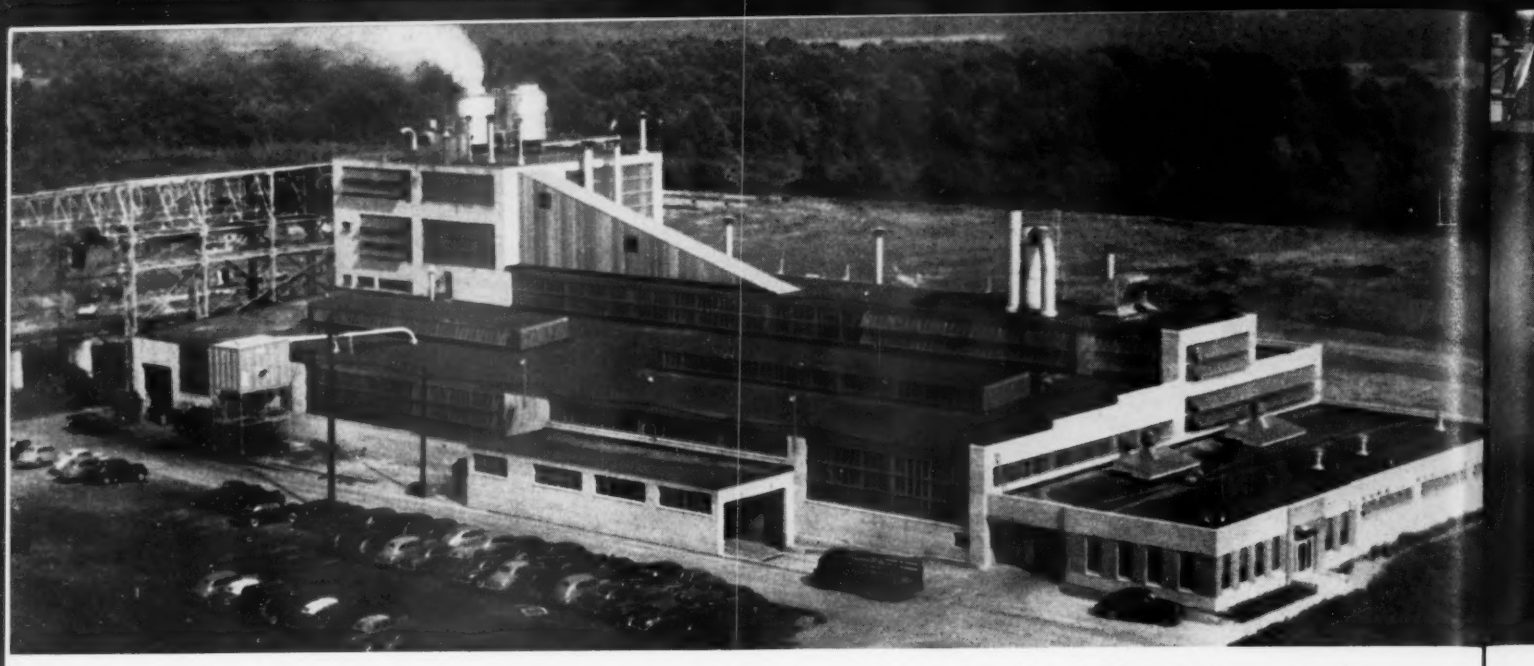


Fig. 1—Exterior view of Budd Co.'s high production foundry

Casting Brake

AT THE BUDD CO

By JOHN HOWE HALL
Consultant
Swarthmore, Pa.

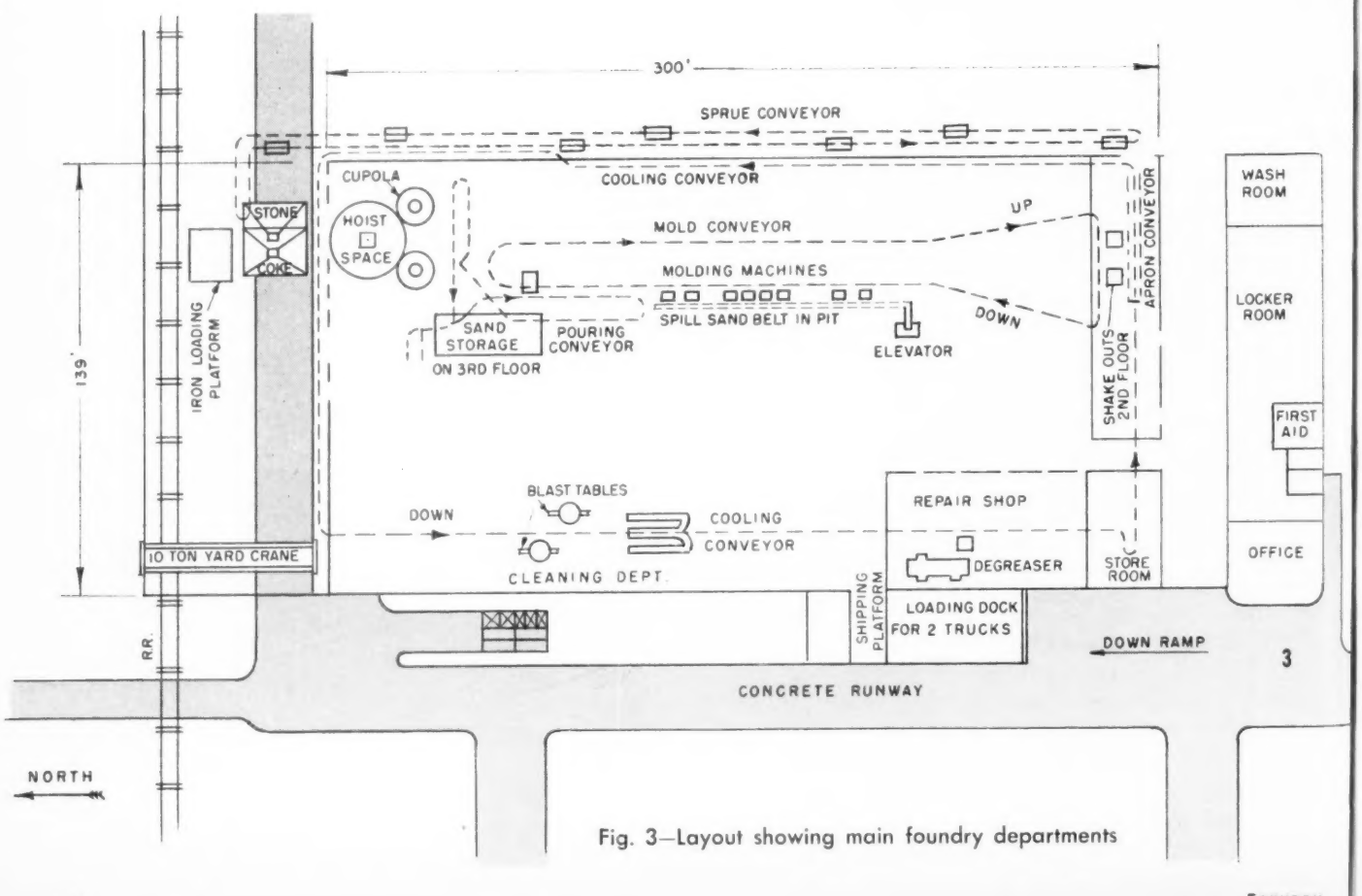


Fig. 3—Layout showing main foundry departments

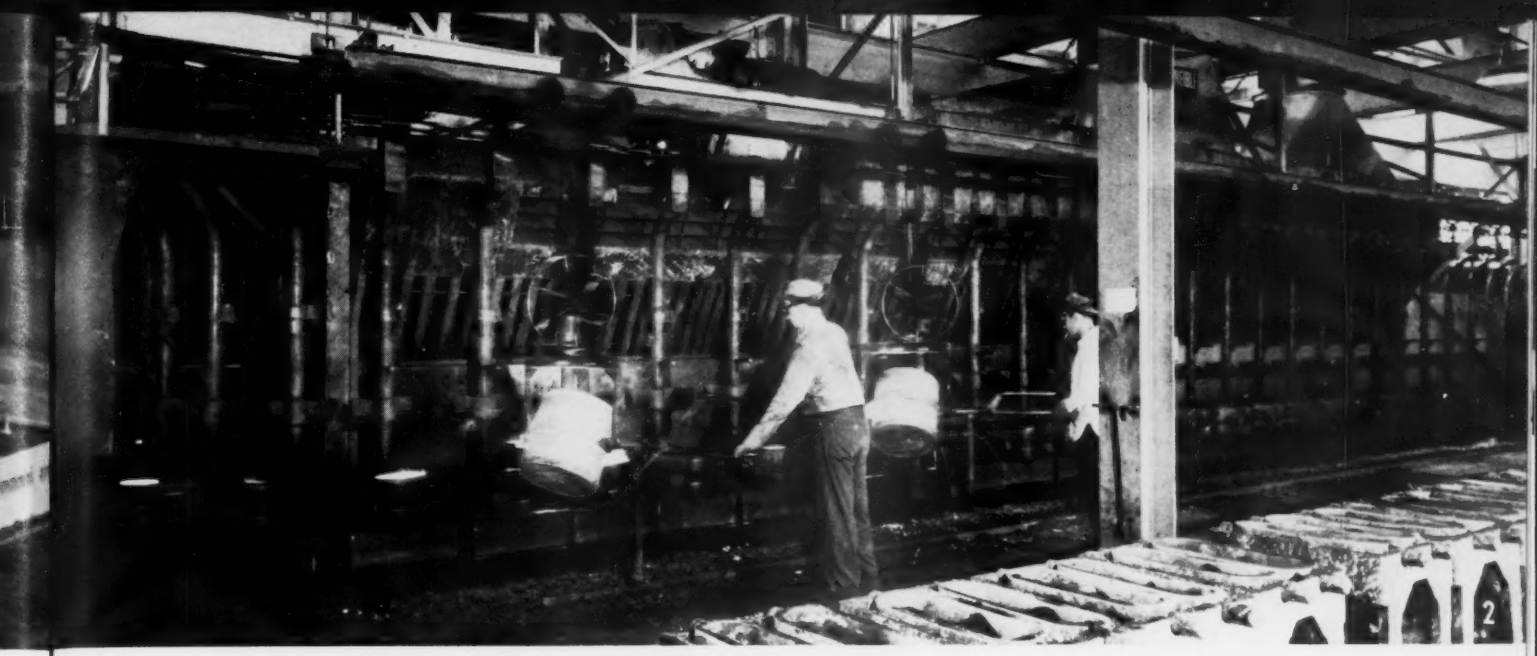


Fig. 2—Pouring station is equipped with effective exhaust hood

eDrums

OUNDRY

IN JULY, 1950, the Budd Co. placed in operation at its Red Lion plant in northeast Philadelphia, a new foundry to mass produce brake drums for the automotive industry. Designed by Budd engineers, after a study of production foundries operated by other companies, the new plant produces upward of 4000 castings per 8-hour shift, yet employs only fifty men.

The drums being made at present comprise gray-iron rims weighing about 15 lbs each, integrally united with pressed steel back-up plates. The latter weigh about 2 lb apiece, and are made at another Budd Co. plant. Before they are set in the mold, the oil with which they are coated to prevent them from rusting, is removed by degreasing equipment.

The castings are poured in green sand, in two-piece flasks 16 in. square, with 7½-in. deep drags (shown in Fig. 5), and 5-in. deep copes visible in Fig. 4. Before closing the mold, a strainer core 2½-in. in diameter and ⅜-in. thick is set in the drag at the bottom of the down gate, and the back-up plate is placed in position on the sand of the drag and centered by means of a removable pin held in a central pocket in the drag flasks. To cut down the weight to be lifted, a space is left in the sand of the cope, over the back-up plate, which is filled with loose sand after the mold is closed. The castings, which somewhat resemble shallow baking pans, are shown in Fig. 6.

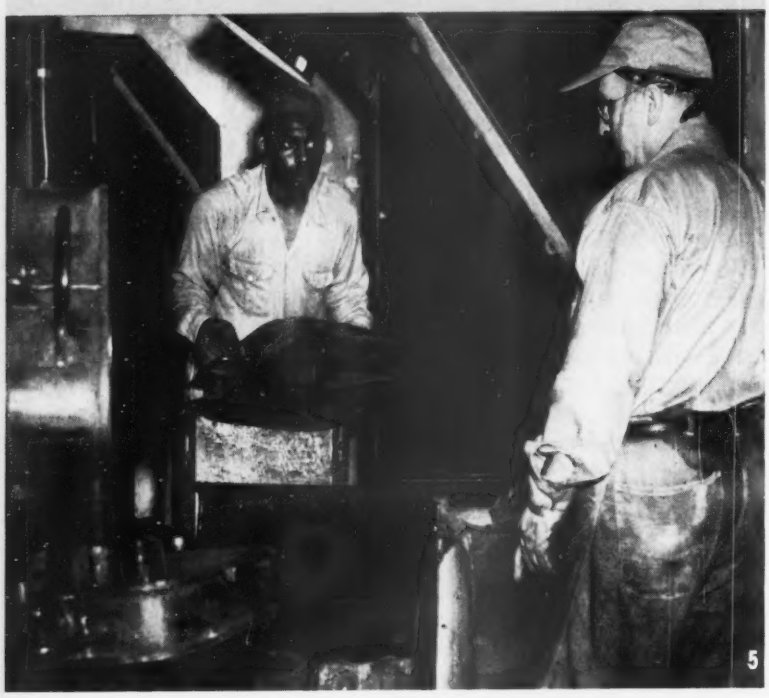
Fig. 1 is an exterior view of the foundry, and Fig. 3 a layout of the chief items of mechanical equipment. A continuous mold conveyor, illustrated in Figs. 2 and 4, travels behind the molding machines, where the operators place the rammed flasks on it, and the space provided for closing and pouring. The conveyor then enters an enclosed smoke hood, reverses its direction and travels back toward the shakeout. On the east side is an opening large enough to permit one man to enter and unclamp the molds as they pass. At the shakeout, located in an enclosed area 15 ft above the general foundry level, the empty drags are set on the pallets, and the copes are hung on hooks on the conveyor, as shown in Fig. 4, and returned to the molding area. Sprue is carried on a short apron conveyor to a chute that discharges into buckets hung on a conveyor outside the building. This conveyor operates intermittently, moving forward each time a bucket is filled.

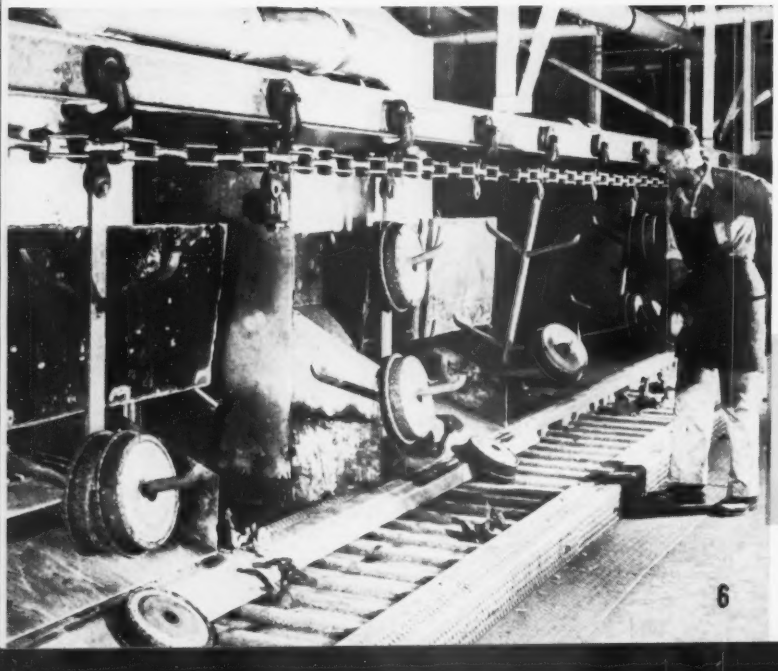
From the sprue conveyor at the shakeout, the castings are picked up and hung on hooks on a cooling conveyor, as illustrated in Fig. 6. This conveyor makes a complete circuit of the foundry, rising from the shakeout level to a point above the main foundry roof, where it passes to the outside of the building and continues along the north and east sides. In this portion of their travel, the castings are protected from rain or snow by a light roof over the conveyor.

Re-entering the building at the north-west corner, the conveyor slopes downward to the cleaning department, where the castings are lifted off and set on the tables of the airless blast machines, as shown in Fig. 7. The trip from shakeout to cleaning room is made in 90 minutes. The empty conveyor then passes back to the south end of the plant, goes around a take-up and rises again to the level of the shakeout.

At the shakeout the sand is discharged onto a short four-ply glass fiber collector belt, thence to a magnetic pulley belt that removes tramp iron and discharges it down a chute to a bucket at ground

Fig. 4—Rammed flasks are placed on continuous mold conveyor visible to the rear of the machine operator





level. After passing through a revolving screen that breaks up lumps of sand and removes coarse pieces, the sand is carried on a long belt and discharged into the storage bins, located at high level above the mullers. The sloping structure covering the upper portions of this inclined belt can be seen in the general view of the plant.

From the storage bins, the sand is fed to mullers, where the necessary additions are made, thence to an aerator, and finally to a distributing belt supplying the hoppers over the molding machines. Spilled sand from the machines falls through a grating onto a belt traveling in a pit below floor level, and is discharged onto a short cross-belt that feeds a bucket elevator. The latter dumps onto the main sand return belt leading to the storage bins. The "excess" from the distributing belt that serves the hoppers at the molding machines is discharged onto the spill-sand belt below floor level. The pit in which this belt runs is very wide, to permit ready access for servicing, and is provided with an exhaust fan for ventilation and a sump-pump to guard against flooding. Incidentally, it should be remarked that at every point in the plant, ample space is provided around the mechanical equipment to permit servicing and greasing. To show the return and distributing sand belts in Fig. 3 would so complicate the drawing that it would be difficult to grasp the general arrangement of the equipment.

As illustrated in Figs. 2 and 3, the metal is brought from the cupolas in shank ladles carried by pouring devices suspended from trolleys on an overhead track. As they travel in the opposite direction from the molding conveyor, the first mold poured is at the point nearest the entrance to the smoke hood. This arrangement prevents any molds from entering the hood without being filled with metal.

Operates Eight Machines at Present

Ten jolt-squeeze-stripper machines are provided, of which eight are at present used to make the molds. Beginning at the south end of the battery of eight, first are two machines making drags, then a space, then two cope and two drag machines together, then a space, and finally two cope machines. With this arrangement, a gang of eight men operating the machines, two setting strainer cores and backup plates and two clamping and removing pins, constitute the molding force.

One man stationed at the point where the conveyor levels off as it comes down from the shakeout floor sets the drags on the proper pallets, so that the second drag molder puts his rammed flask on the pallet from which the first man removed his. One core-setter works in the space following the first two drag machines, and one in the space ahead of the last two cope machines. They set the strainer

Fig. 5—Removing a drag flask from the shakeout
Fig. 6—Transferring castings from shakeout to hooks on cooling conveyor. Sprue is removed by apron conveyor to buckets outside the building

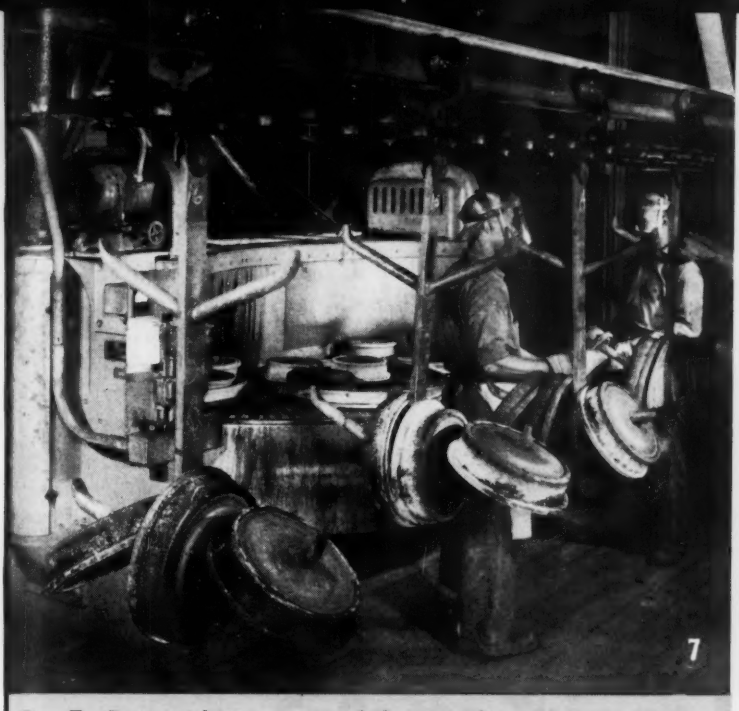


Fig. 7—Castings being removed from cooling conveyor for cleaning on airless blast machine table

Fig. 8—View of yard showing 20 x 20-ft loading platform used in filling cupola charging buckets

cores and back-up plate with its centering pin, and put the flask pins in position in the drag flasks. The cope molders then are able to set their copes on drags ready for clamping. One of the men closing molds sets the clamps and removes the flask pins, the other removes the centering pins from the back-up plates and fills the openings in the copes with loose sand. The centering pins, flask pins and clamps are placed in baskets mounted on the hangers carrying the mold pallets, as shown in Fig. 2

The sand used to fill the open spaces in the copes is sometimes mixed molding sand, and sometimes one of the two kinds of new sand used. Most of the new sand required for operating the system is introduced in this way. The sand used for the cores is brought into the plant in dump buckets, discharged on to the spill-sand belt, and carried from the main return belt through a chute to a 50-ton bin in the coreroom. Extra sand required at any time is introduced in the same way, and sent to the main storage bins. About 1 ton of new sand is added each day, and the total amount in the system is approximately 300 tons.

Each molding machine rams 130 flask sections per hour, the total from the eight machines being 520 complete molds. Each mold requires 92 lb of sand—45 lb in the drag and 47 lb in the cope. Thus a little over 23 tons per hour is needed to feed the eight machines. Estimating spillage of 2 tons per hour, the total sand requirement is approximately 25 tons per hour. To allow for future expansion of the plant, the mullers, aerator and distributing belts have a capacity of 75 tons per hour. The present production is 4160 castings per shift of eight hours.

The design permits installation of a second molding and pouring line in the space between the present one and the cleaning room. To serve this second line, it will be necessary only to install the molding machines, mold conveyor, spill-sand belt and a second sand distributing belt over the hoppers. For a third and fourth line, the plans call for removing the east wall of the foundry and increasing the present width of the building. At a later date, a certain amount of floor molding may also be done in the area between the present smoke hood and the east side of the building.

The sand used consists partly of natural bonded sand containing 16 per cent clay, and partly 82 mesh-silica sand. Western bentonite and seacoal are added in proper proportions to maintain a green strength of 6 to 8 lb, and a permeability of 100 to 150, with a moisture content of 2½ to 3 per cent, and 10 per cent volatile matter. Molding sand is prepared in two 3000-lb capacity, automatically controlled mixers. The two storage bins over the mullers are each divided into two compartments, with measuring hoppers from which the sand is discharged into the pans. The two bins have a total capacity of 275 tons of sand. The temperature in the bins is measured and recorded, and the hoppers are used alternately to keep all the sand constant and in use. Exhaust is provided to remove 3000 cfm of air from the bins by means of static ducts. A well-equipped chemical and sand-testing laboratory is located near the mullers, to analyze samples of the iron and to check the properties of the batches of sand.

From the mullers the sand is carried by a belt to a rotary cage type aerator, discharging onto the main distributing belt that feeds the individual hoppers over the molding machines. The plow-off over each hopper is operated by an ingenious automatic device designed by Budd Co. engineers, which makes it unnecessary for any one to handle them. It is enough for the man running the mullers to keep his eye on the belt and plows to be sure they are operat-

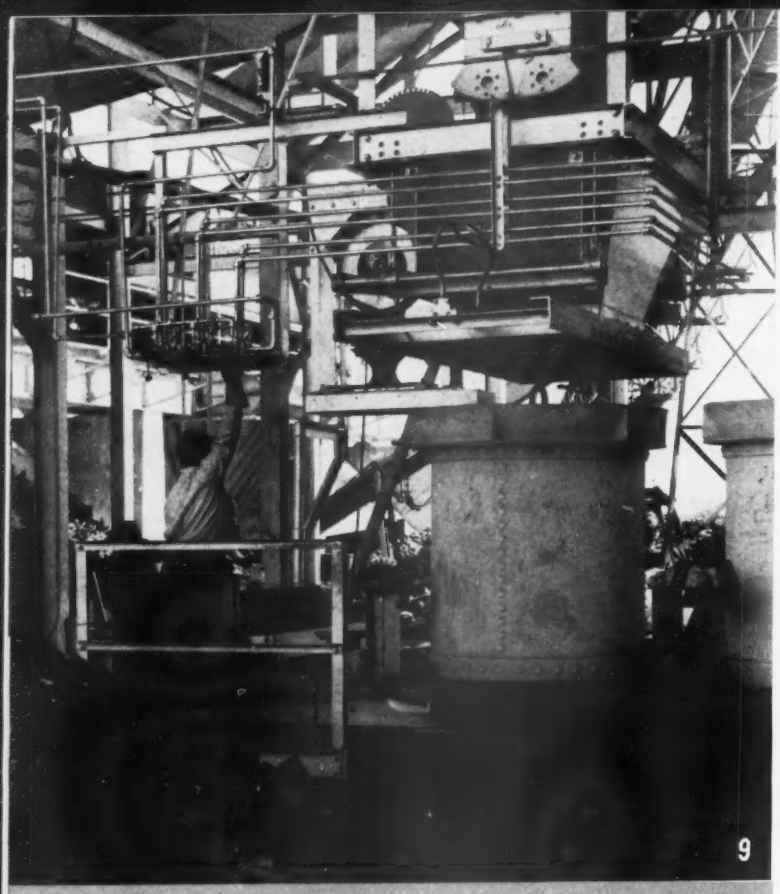


Fig. 9—Charging buckets are moved into position under the weigh hoppers by means of transfer car

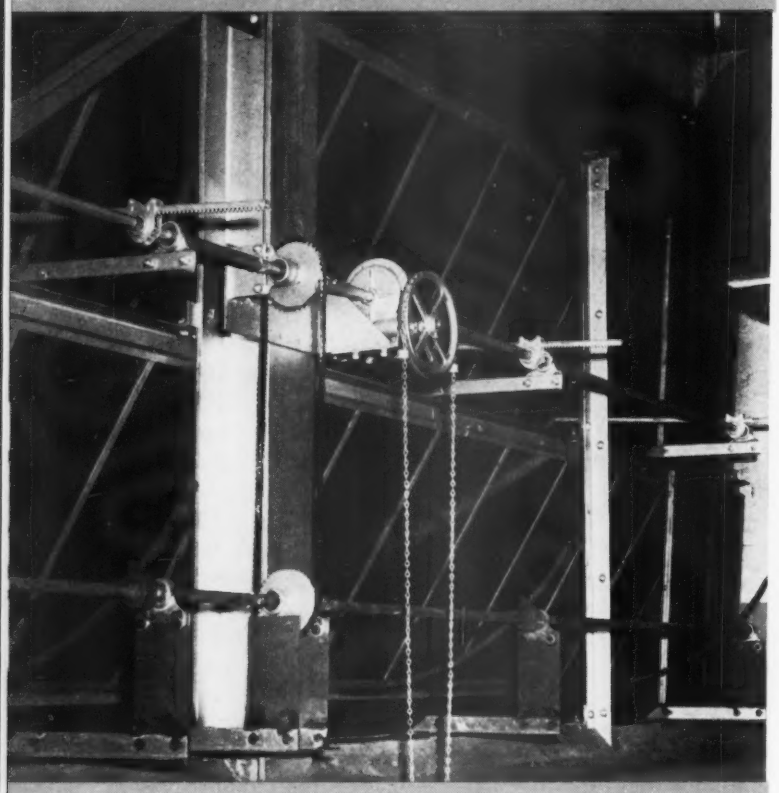


Fig. 10—Long windows, suspended from the top, are provided to help ventilation during warm weather

ing properly. The device consists of a vertical steel plate near the top of the hopper, set parallel to the distributing belt, and pivoted to swing on a horizontal axis. When the hopper is nearly full, the sand pouring off the belt pushes this plate to one side, thereby actuating a device that raises the plow and cuts off the flow of sand. When the level of the sand in the bin falls below the bottom of the plate, it swings back to the vertical position and lowers the plow again.

The coreroom is located at second floor level near the mullers. Core sand is mixed in a 700-lb capacity muller. Twenty-one strainer cores in a box are rammed by machine, one man producing from 6000 to 8000 cores in four hours. The cores are dried in a vertical oven. When drums for a ½-ton truck are being produced, another small core is required, to form an inspection hole in the casting. Sufficient space has been provided in the coreroom to furnish cores for four molding lines, and also for some floor molding.

Six pouring devices, with ladles holding approximately 450 lb of iron, are provided, three being in operation at a time. Skimming lips are built into the ladle linings to hold back slag and loose dirt. As the mold conveyor moves forward, the pourer easily keeps his stream centered in the sprue, since the pouring devices are swung from trolleys that move almost at a touch. As can be seen in Fig. 2, behind the pouring area is the inclined grating of a dust collecting system, which prevents any smoke or dust from escaping into the building. This hood exhausts 24,000 cfm of outside air introduced through special louvres, and 9000 cfm from the area around the pouring operation.

Removes Practically All Dust

The poured molds enter a hood covering the north and most of the east sides of the conveyor. The exhaust system draws off 30,000 cfm of fresh outside air introduced into the hood through louvres, and 18,000 cfm drawn from the foundry area through the opening in the east side of the hood and another in the south end. There is also a smoke hood over the cupola spouts, taking 10,000 cfm of air from the foundry space.

On the shakeout floor are two 4 x 6 ft machines. Here a force of five men pull the flasks off the conveyor with hooks and shove them onto the shakeout machines, put the empty flasks back on the conveyor (Fig. 5), and pick the castings off the apron conveyor and hang them on the cooling conveyor (Fig. 6). Dust hoods over the shakeouts, sand return belts and revolving screen exhaust 37,000 cfm of air, into a dust washer and collector, which can be seen projecting above the roof near the south end of the building, in Fig. 1. This wet-type washer removes 98½ per cent of the dust in the air, which is settled out in a tank north of the scrap yard, and the water recirculated.

The sprue conveyor outside the building carries nine buckets. The one under the spout of the chute that leads from the apron conveyor rests on a scale so arranged that when the desired weight has accumulated in the bucket, (*Please turn to page* 194)

The author, since 1932 dean of the College of Engineering, University of Detroit, was closely identified with the foundry industry for ten years at the Falk Corp., Milwaukee. His keen analysis here of the problems incident to encouraging young men to enter the foundry industry originally was presented before the Detroit Chapter, American Foundrymen's Society

The Dean Calls the Turn on

Foundrymen and Foundry Boys

By CLEMENT J. FREUND

THE academies at West Point and Annapolis are the most romantic symbols of our country's military history and might. But West Point and Annapolis represent something besides military history and might; they represent an idea—an American idea. They are training grounds where successive generations of young men have prepared to become officers in the United States Army and Navy. Have you ever observed that all strong, flourishing American institutions, like the Army and the Navy, are very much concerned about the business of taking in recruits; and that they all operate a training system of one kind or another, which they take very seriously?

For instance, the medical profession is securely established in our American community, without any question. And the schools of medicine are exceedingly important in the medical scheme of things. The Bell Telephone System is vigorous and successful; and no industry has more elaborate schools. General Electric Co. and Westinghouse Electric Corp. are not exactly falling apart; and both are famous for their apprenticeship systems and the way they bring along their engineering college graduates. And here in Michigan we have the General Motors Institute of Technology, the Chrysler Engineering Institute and the Ford Apprentice Schools.

The foundry industry is no exception to the rule. The American Foundrymen's Society has had educational committees as long as I can remember. I believe you will find that the first committee of the society was the Apprenticeship Committee.

And you have something special and different. You have the Foundry Educational Foundation. Yours is the only industry I can think of with a joint, industry-wide plan for the schooling of engineering college students and graduates.

If you keep on pushing education and training, I am ready to prophesy that, before many years have passed, you will be amazed by the prosperity of your industry. It has always been that way and it always will be—first, good schooling and training; then, prosperity and success.

Because I make my living in a college of engineering, I hope you won't mind if I confine my remarks pretty much to the encouragement of young college men for the foundry industry.

One thing is sure. To encourage the young men to get into the foundries is exceedingly necessary. Why is it so necessary? For one thing, because there aren't enough boys to go around. The number of high school graduates per year in the United States dropped by 150,000 between 1949 and 1952. The low birth rate of the 30's is catching up with us now and bedevils all our industries.

It is all very clear if we examine the situation in engineering. The Engineers' Joint Council tells us that American industries had 80,000 jobs waiting for engineering college graduates last year but only 38,000 were graduated from the colleges. About half of these 38,000 went into the armed forces. That left the other half, or 19,000 to take up 80,000 jobs!

Employers compete strenuously for what few engineering graduates there are. (*Please turn to page* 257)

MECHANIZING FOR

Increased

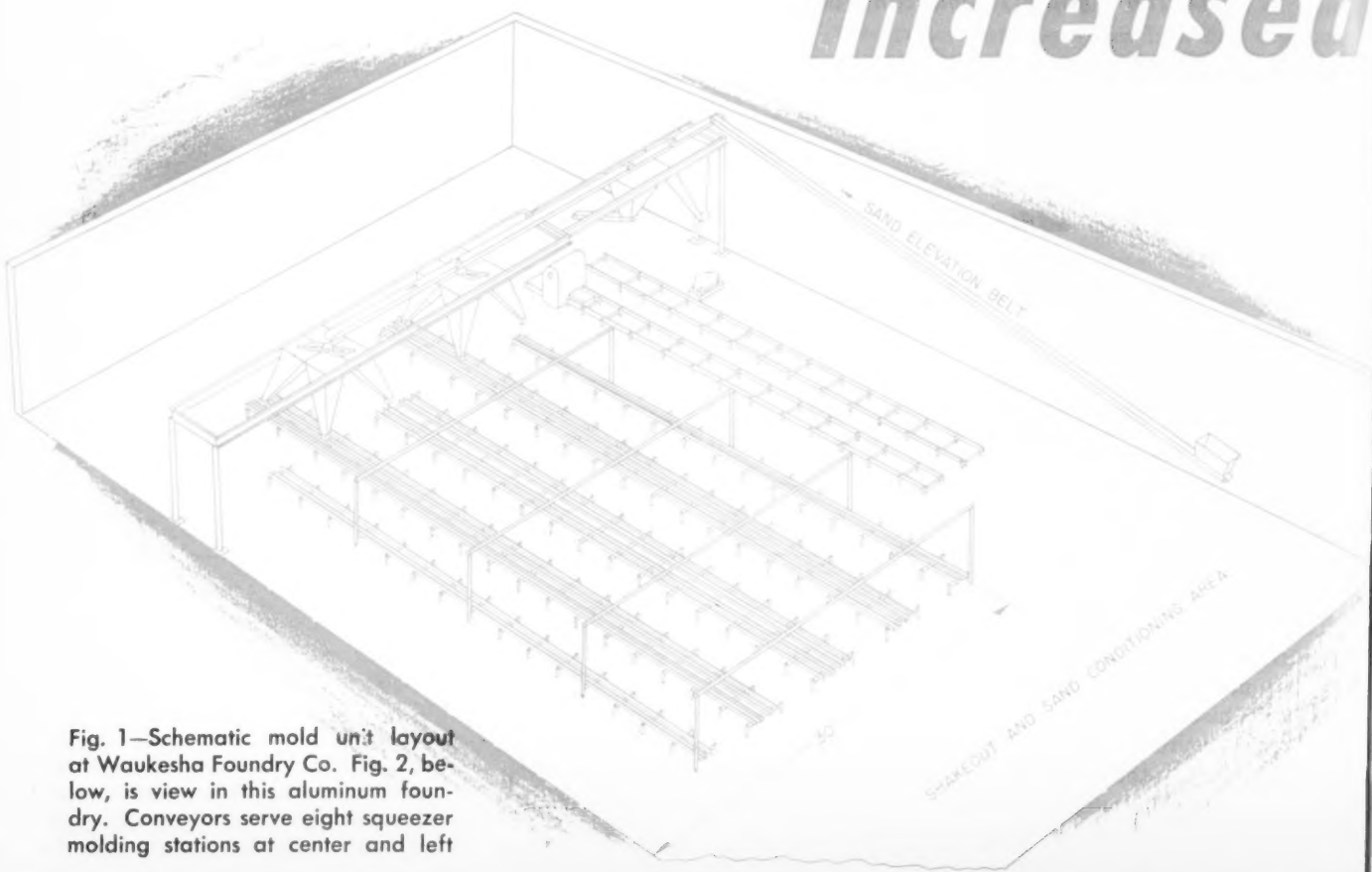
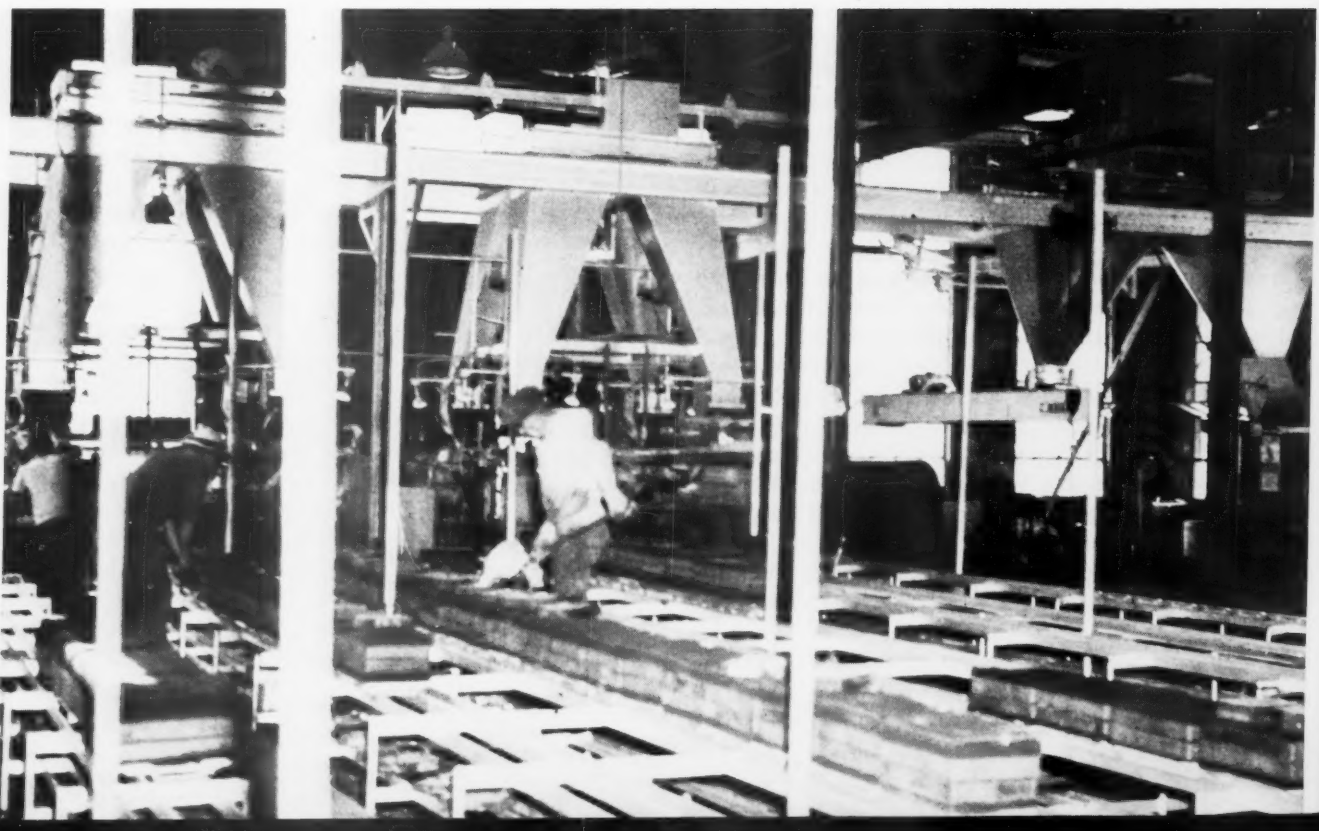


Fig. 1—Schematic mold unit layout at Waukesha Foundry Co. Fig. 2, below, is view in this aluminum foundry. Conveyors serve eight squeezer molding stations at center and left



By ERLE F. ROSS
Chicago Editor
FOUNDRY

d Production

MECHANIZATION is the key to increased foundry production, improved practice and lower unit costs. Even partial mechanization, or installation of modern handling procedures for specific operations, by removing bottlenecks, can speed up castings output and yield benefits beyond what might be expected normally.

The trend in recent years has been toward more and more mechanization but the greatest acceptance has been in large and medium-sized shops where the volume of repetitive work is considerable. Here, large expenditures of money for new equipment can be justified more easily. Many foundries, lacking such volume and confronted with diversification of product, find themselves handicapped in undertaking improvement programs entailing large capital investments.

With an eye to accommodating the requirements of this latter group as well as the larger shops in the industry, Nomad Foundry Equipment Division of Westover Engineers, Milwaukee, recently designed and introduced a self-contained and self-supported foundry unit, features of which have been covered by patents. This consists of light-weight but sturdy gravity mold conveyors, roller-mounted bottom boards or pallets, and a sand distribution system. The various elements are of standardized basic design which can be readily adapted to the requirements of a given installation. Furthermore, a choice of the elements can be as extensive or as limited as desired. In other words, selection and adaptation of the equipment affords a high degree of flexibility.

The mold conveyor, in its simplest form, consists of 1¼-in. pipe supports separated by spreader bars and joined by welding. The rails are special-rolled round-edge steel bars inset and welded into the pipe supports. Conveyor height, ranging from near floor level to molding machine table level is determined by length of the pipe sections and width by length of the spreader bars. Conveyor sections are bolted together to provide any desired length of system, and leveling is accomplished by adjusting screws on the bottoms of the pipe supports.

One of several conveyor design variations has three top rails to accommodate different widths of bottom boards. A second set of rails, at lower height, provides a means for transporting bottom boards back to molding stations. Thus one conveyor can be made to assume a dual function. Another design variation makes use of two instead of three rails.

A typical roller-mounted bottom board is shown at the bottom in Fig. 3 in its normal position for carrying a mold; above in this view it is turned over to show mounting of the rollers. The board proper is an aluminum casting and the three ball-bearing, hardened steel flanged rollers are securely locked in place in slots in the ribs. Bearings for the rollers are of the dry type, requiring no lubrication. Large molds are usually placed on either wooden or steel pallets to which are bolted aluminum trucks equipped with from two to four rollers. In some instances where very large molds are to be conveyed, as many as eight rollers are used. Three-roller support of the aluminum bottom boards assures level and free movement on the conveyor rails.

The sand delivery system can be varied to meet requirements but essential elements are a sand elevating belt, a distributing belt, sweeps and hoppers to serve individual molding machines. An important feature of the system, however, is that, being self-contained and self-supporting, it is erected independent of the building structure. Where installation is to be made in an existing building, this advantage is obvious.

Some months ago, the Nomad molding system was installed in the aluminum foundry of the Waukesha Foundry Co., Waukesha, Wis. It serves eight squeezer molding stations, a rollover unit and a pinlift unit. Schematic arrangement of the installation is shown in Fig. 1, and a general view in Fig. 2.

The eight squeezer stations are arranged in two clusters of four each, and each station has its own sand hopper and its own gravity mold conveyor line. The conveyors are of the three-rail type with spreads

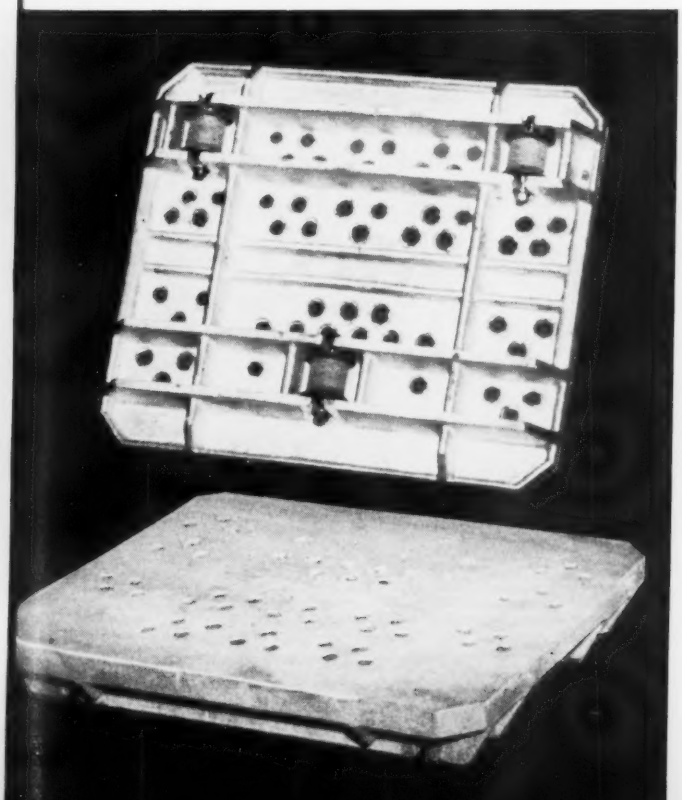


Fig. 3—Cast aluminum pallets incorporate three hardened flanged rollers with dry type bearings

Fig. 4—Pouring aluminum into large molds on conveyor serving the rollover molding machine

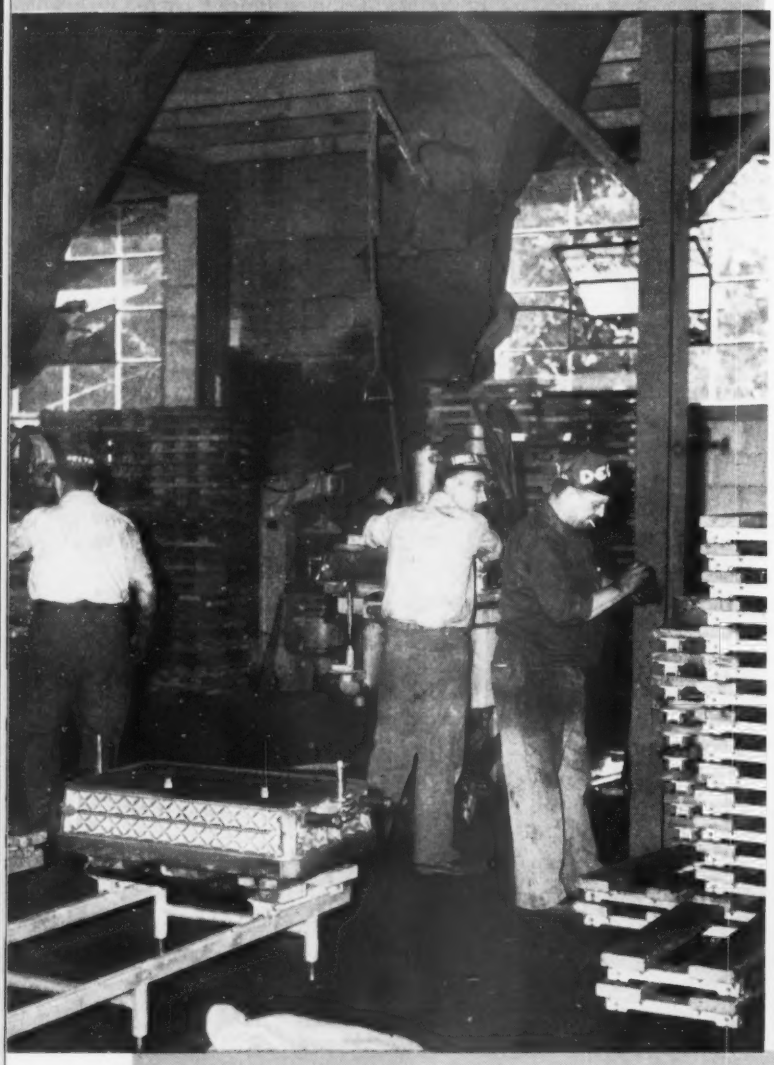


Fig. 5—View in Slinger Foundry Co. showing molding machine, stack of wood pallets and drag mold on conveyor. Fig. 6 (right)—Conveyors carry the molds from molding stations through pouring and cooling to main conveyor for transfer to shakeout

of 7 and 11 in. to accommodate different widths of molds and bottom boards. The boards are cast aluminum with rollers built-in as previously described. This type of construction protects the rollers from sand, dust and spilled metal, and also allows the molds to be moved down the track with a minimum of effort and freedom from jolting or vibration. Furthermore, the round edge top of the bar-shape section track is self-cleaning, does not accumulate dirt on the track or supporting structure and sheds any spilled metal.

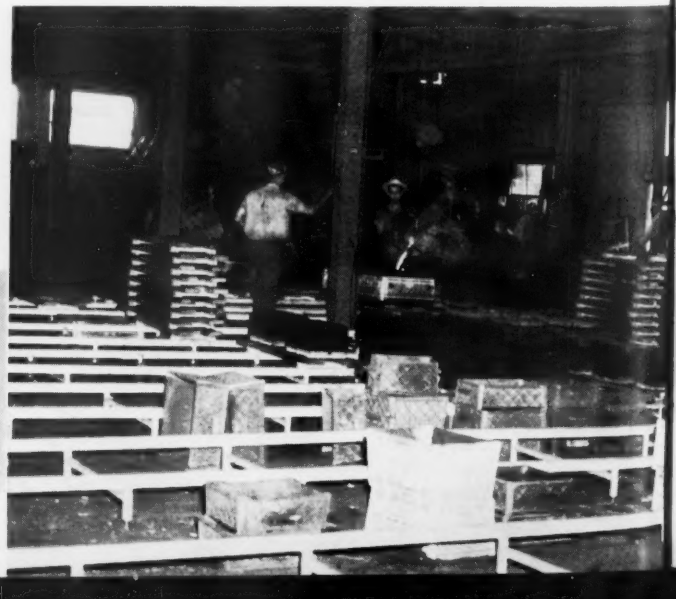
Molds made in the squeezer stations are placed on the conveyors and moved down the line by gravity for placing of weights and jackets, pouring and cooling. The track structure incorporates posts for future installation of an overhead pouring system. Open construction of the track provides for easy cleaning of the floor area around and under the track.

After pouring and cooling, the molds are taken off the conveyors and dumped on the floor for shakeout. Installation of a mechanical shakeout is contemplated. Meanwhile, on those occasions when a congestion of molds occurs on the conveyors, the excess is pushed off onto two home-built caster-mounted conveyor extensions. Bottom boards can be returned to molding stations on the second level rails of the conveyors; however, the practice is to return them by floor trucks.

The rollover molding machine is served by a conveyor 33 in. wide built close to the floor. It accommodates pallets 37 in. wide and 30 in. long, made from 2 x 6-in. lumber and having double-roller trucks attached under the four corners. Various sized bottom boards are used on these pallets.

A pallet is positioned on the track over the draw table of the molding machine. Raising of the draw table lifts the pallet against the bottom board of the drag mold. Drawing and lowering the draw table automatically leaves the pallet and drag resting on the track ready to be rolled along the track to the closing position. Several drags can be stored on the track for closing. The copes are made on a jolt pin-lift machine and moved to the closing position by monorail hoist.

Molds are poured on the conveyor line, which is approximately 42 ft long. This pouring operation is



shown in Fig. 4. Adjacent to the pouring line is a second conveyor track which provides rollover flask and pallet return. The manner in which the rollover and pinlift operations are set up provides fast return, thus the number of pallets is held to a minimum. Two molders work on this unit using a variety of flasks ranging in size from 30-in. square to 42 x 72 in.

Shakeout sand from the squeezer molding unit and the rollover unit is cut over on the floor and transported by power truck to a belt conveyor. Conditioned sand is returned to the molding stations by an inclined belt which spills to a distributing belt from which the sand is plowed to the hoppers or spills over the end to the last cluster of hoppers over the squeezer stations. Each hopper contains a level switch which automatically controls the plows. These switches are interconnected to shut off the belt feeder when all hoppers are filled. Such arrangement eliminates need for stationing a man by the distributing belt to control the flow of sand to the hoppers.

Hoppers for each of the two groups of squeezer machines are built in a cluster of four with a power-driven sweep to distribute the sand over the four hoppers. Two sides of the individual hoppers are built with negative slope to facilitate free flowing of the sand within them and prevent possible clogging. Another advantage of this type of constuction is that it permits the location of four molding stations in a space only 13½ ft square.

Over each squeezer machine on the bottom of the sand hopper is a counter-weighted chute. Thus, sand passes through an air-operated clamshell gate into the gathering hopper and counterweighted chute into the mold.

Because of the low headroom afforded and location of the rollover machine, this unit is fed with sand by a belt feeder which pivots on its hopper and is supported by a monorail at the outer end. This swing filler is 9 ft long and rotates through an arc of 180 degrees. The pinlift molding machine is so located that its sand hopper is mounted immediately over it.

Through modernization of its facilities, Waukesha Foundry Co. has tripled its squeezer production and has achieved this increase in output with fewer machines and men. Formerly the shop used 15 to 18 men on squeezer work, but now utilizes only 8 men. Production varies somewhat, however, according to sizes of molds being turned out. Some of the benefits which the management has derived through its improvement program are: More good castings, production is continuous, labor is saved, workmen experience less fatigue, and space is conserved—all of which add up to cutting of costs.

Faced with the necessity of speedy reconstruction of its gray iron foundry after a disastrous fire destroyed a major portion of its facilities on Mar. 30, 1951, Slinger Foundry Co. Inc., Slinger, Wis., installed 14 Nomad conveyor lines. The company had a substantial volume of defense-rated orders on its books at time of the fire and early resumption of operations was important. The Nomad conveyors proved to be the solution to the problem, because by virtue of their simplicity of construction they could be supplied quickly, and partial resumption of the foundry was effected in approximately six weeks.

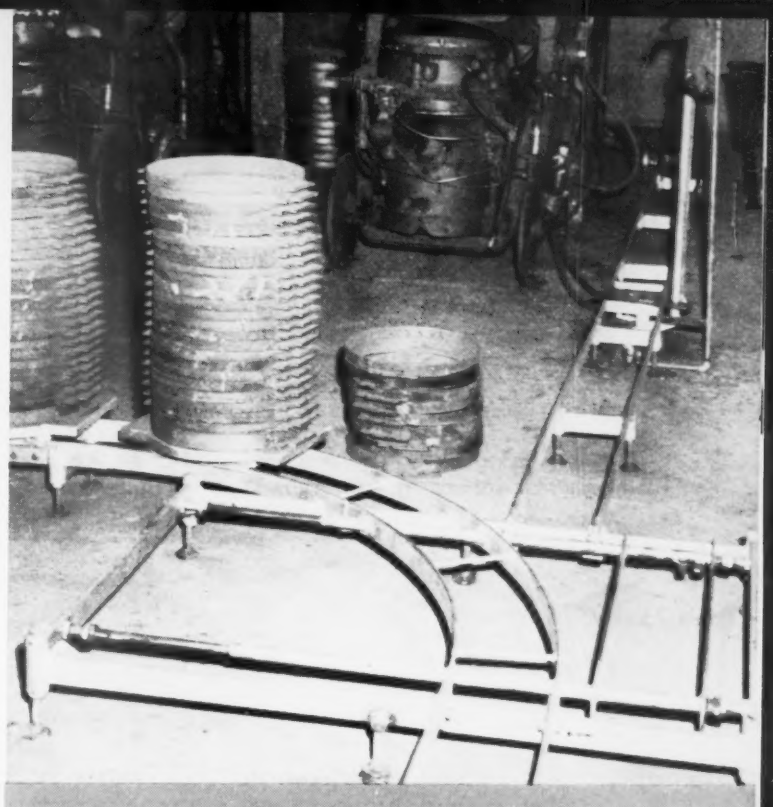


Fig. 7—Switches and curved track feature conveyor installation at foundry of Engineering Castings Inc.

Fig. 8—Nine movable track sections provide storage for 45 poured mold stacks prior to shaking out

The reconstructed foundry provides 12 molding machines installed in a straight line. Six machines are squeezers and the remainder are three pairs of cope and drag units. These machines are served by 14 parallel conveyor lines 56 ft long. Ten of the lines are 42 in. wide and four are 24 in. wide, all built low to the floor. Pallets are wood and are supported on two roller trucks each provided with two rollers. Usually two or three molds are placed on one pallet, but where molds are large (*Please turn to page* 253)

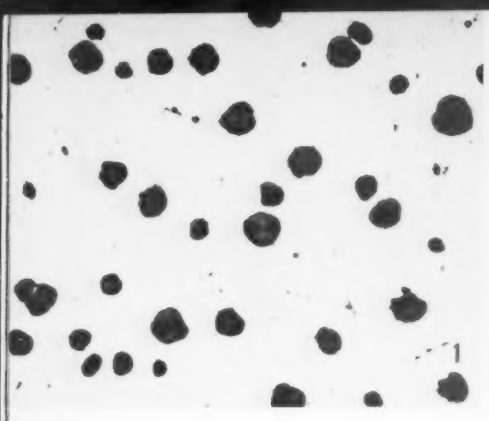


Fig. 1—Spheroidal graphite in magnesium-containing cast iron

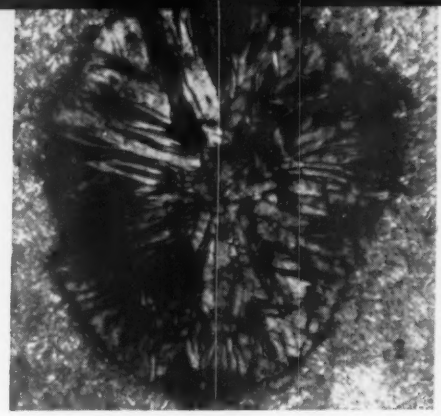


Fig. 2—Graphite spheroid photographed under polarized light

Fig. 3—Cylinder head for reciprocating compressor

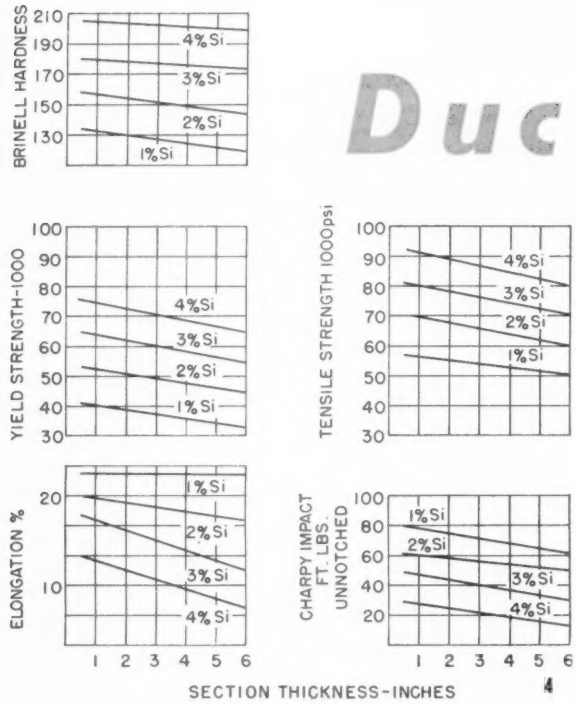


Fig. 4—Effect of silicon on the mechanical properties of Ductile iron in the annealed condition

Ductile Iron—

Its Significance to the Foundry Industry

By ALBERT P. GAGNEBIN
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This review of the development, properties and applications of spheroidal graphite cast iron was presented by the author at the 1951 International Foundry Congress held in Brussels, Sept. 10-14

CASTINGS have been made for thousands of years, and in fact historical documents[1] indicate that cast iron tools were produced for the farmer and the woodworker in China 2200 years ago. Thus the foundry industry represents one of the oldest and most continuous efforts on the part of man to produce useful products. It is a basic industry contributing in a vital way to practically all industrial operations.

Foundry processed component parts once played a much more prominent part than they do today; a century ago, for example, it is quite probable that over one-half of the metal articles produced were processed in the foundry. Such common articles as kitchen utensils, heavy armament, toys, columns for building construction, and hardware were all foundry products. The invention of the bessemer and open-hearth processes to produce steel in large tonnage greatly stimulated the use of metal and the proportion of metal used in the form of castings gradually

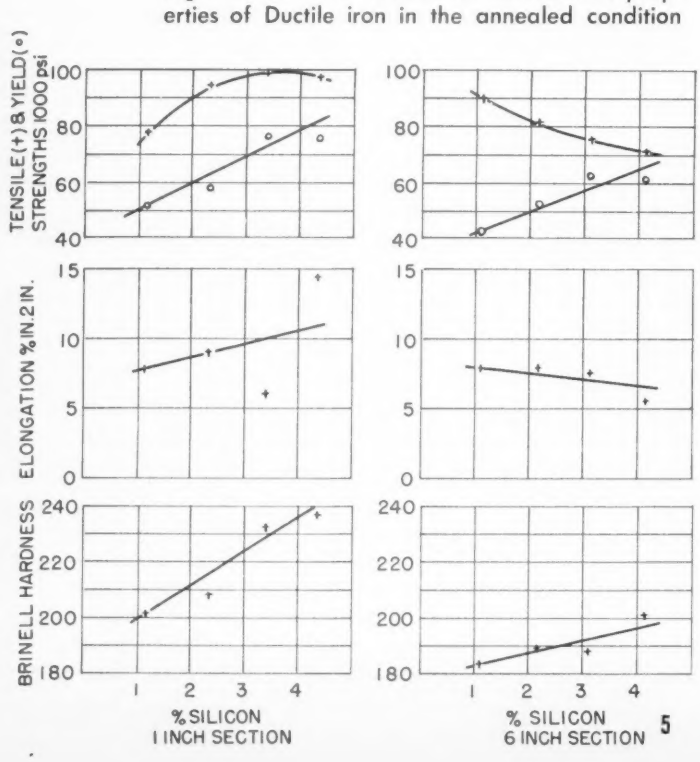

Fig. 5—Effect of silicon on the tensile properties of Ductile iron in the as-cast condition

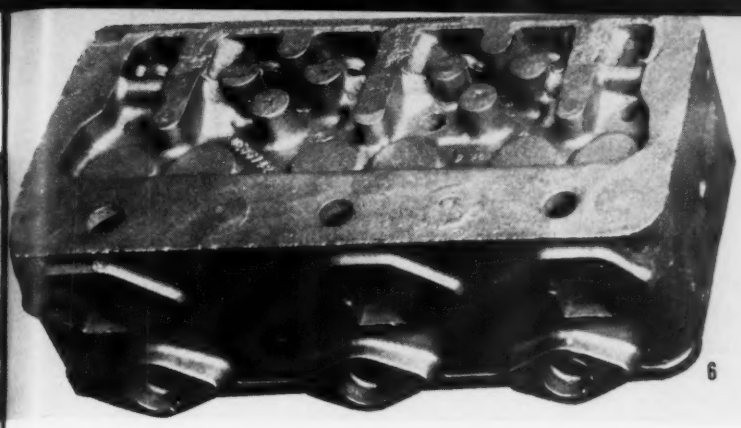

Fig. 6—Head for diesel engine

Fig. 7—Pot weighing 21,000 pounds

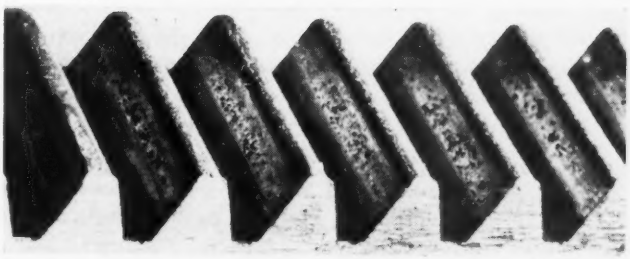

Fig. 8—Gear teeth after 1500-hour test at 50 per cent overload. Forged steel at left, Ductile iron at right

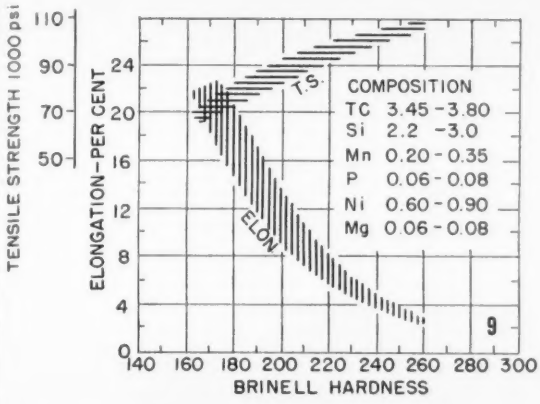

Fig. 9 — Relation between tensile strength, elongation and hardness of Ductile iron in the as-cast condition

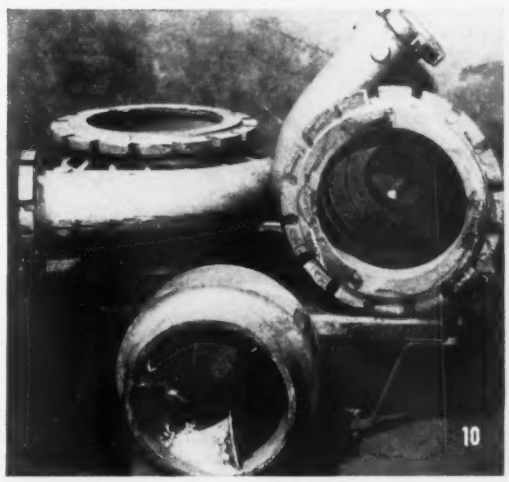

Fig. 10—Casing and impeller for sludge pump. Quenched to brinell of 400 to 450

DUCTILE IRON CLUTCH PLATE

WEIGHT - 23 LBS.

CHEMICAL ANALYSIS

%Si	%S	%Mn	%P	%T.C.	%Ni	%Mg
2.19	.006	.41	.068	4.09	.84	.110

PHYSICAL DATA

	CASTING	1IN. KEEL
TENSILE, PSI	94,800	97,500
BHN	241	241
ELONGATION, %	4.0	5.0
RED. IN AREA, %	3.5	3.5

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Fig. 11—Clutch plate with outstanding service record

Fig. 12—Diesel engine crankshaft

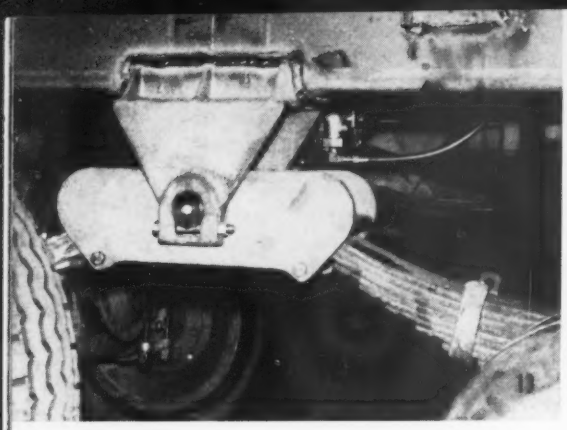


Fig. 13—Casting on heavy trailer

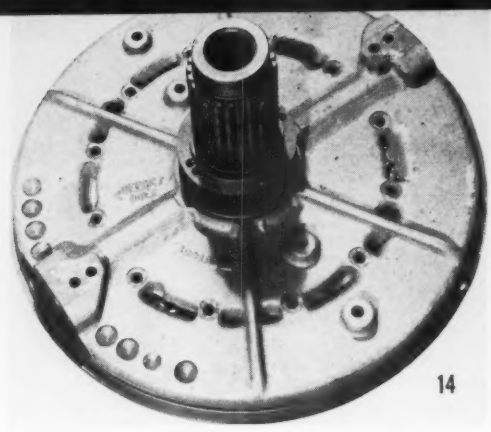


Fig. 14—Ductile iron clutch plate

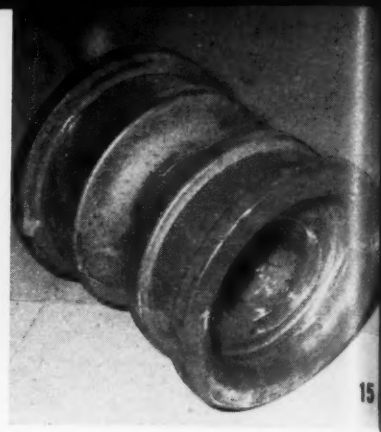


Fig. 15—Tractor lower roller

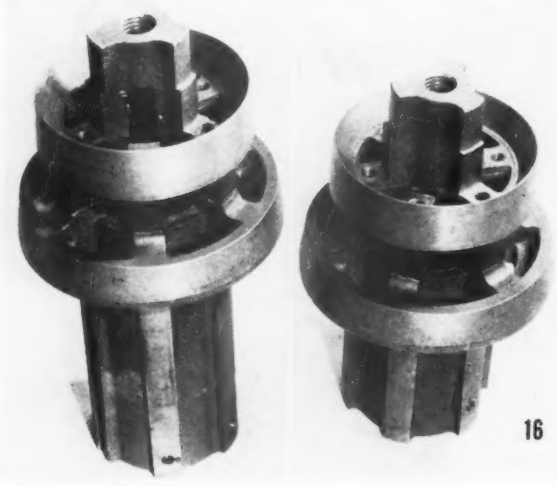


Fig. 16—Armature casting for electrical machinery

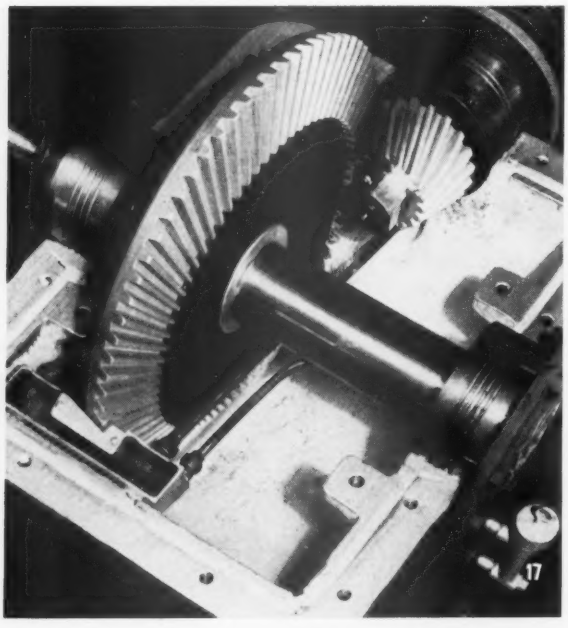


Fig. 17—Flame-hardened Ductile iron ring gear used in a paper mill drive

Fig. 18—Ductile iron fitting welded to steel pipe. The fitting originally was a weldment

diminished until today only about 15 per cent of all the metals produced finds its way into cast products. During this period new methods of shaping steel were devised, new methods of manufacture, such as welding, were developed, new materials such as aluminium, magnesium and plastics were introduced, and all these factors contributed to the increased competition encountered by castings.

The foundry industry was not dormant during this time and, in fact, made great progress in foundry methods, in devising better alloys for strength, heat and corrosion resistance, and in improving casting quality. While it has steadily expanded its production, the increase in the yearly output of foundry products has been at a decelerated rate in relation to the overall increase in the use of metals. There is available now a new engineering material which will alter this situation by greatly stimulating the use of foundry products and which will accelerate the rate of growth of this industry.

Spheroidal graphite iron produced with cerium was announced in the early part of 1948 by Morrogh[2], and at about the same time T. H. Wickenden[3] and L. B. Pfeil[4] announced that a means of producing spheroidal graphite iron by using magnesium had been developed in the Research Laboratory of the International Nickel Co. Inc. at Bayonne, N. J. While the public announcements of this new type of iron have been relatively recent, it should be recognized that there exists a considerable history of accumulated knowl-

Fig. 19—Plow points show wear resistance

Fig. 20—Shaft for paper mill machinery

edge in connection with these new processes. They have been studied in the laboratory over a period of many years and, at least in the case of the magnesium-containing iron, industrial heats had been produced on a commercial scale prior to the announcement in 1948.

While opinions may vary as to the tonnage that will eventually be produced, there is no doubt in the minds of those of us who have been closely associated with this development that spheroidal graphite iron will some day become the second ranking material in the foundry, exceeded in tonnage only by gray iron. In view of this, it seems appropriate to consider this new material from the foundry viewpoint, to outline the knowledge available at the present time with respect to its manufacture, properties and applications, to discuss some of the large (*Please turn to page* 226)

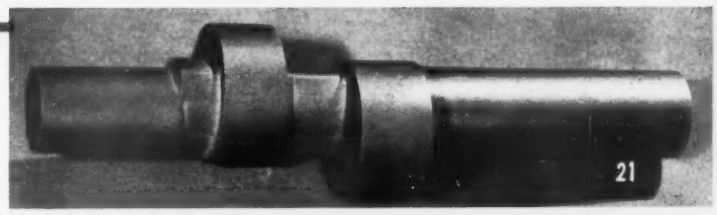


Fig. 21—Crankshaft cast in precision mold

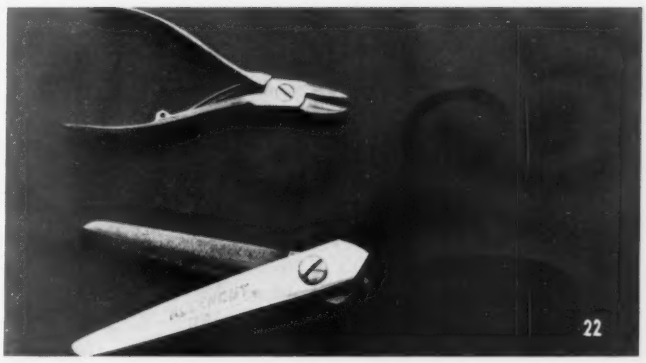


Fig. 22—Ductile iron shears

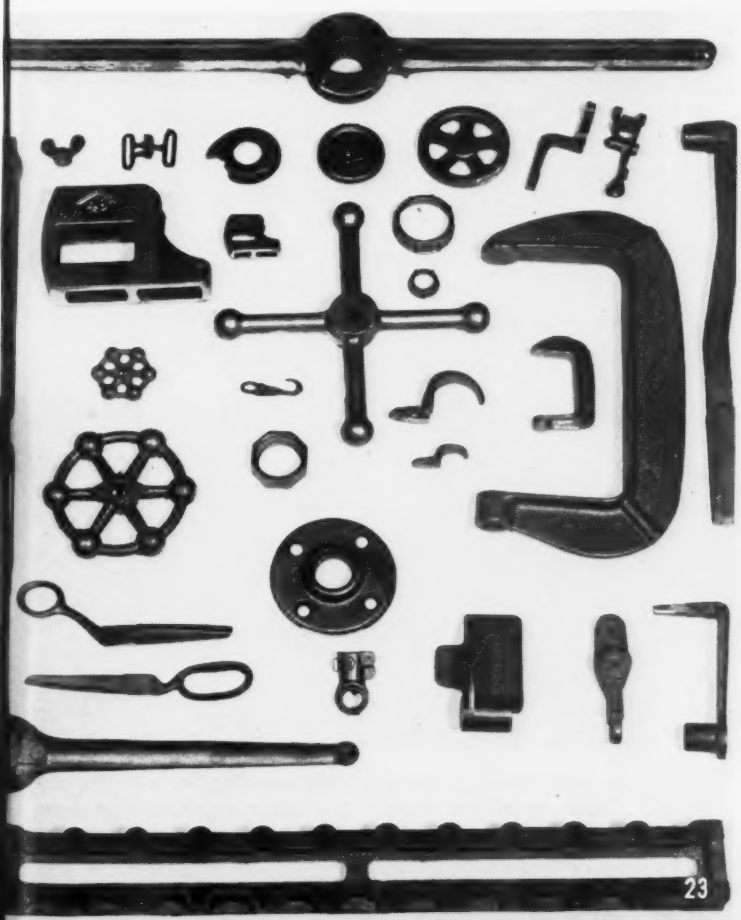


Fig. 23—Production castings

Fig. 24—Anvil weighing 50 tons

By JOHN HOWE HALL
Consultant
Swarthmore, Pa.

Electric Furnace Melting

FOR STEEL CASTINGS

In this second of three articles the author concludes his discussion of basic electric furnace practice and takes up the acid electric process with special reference to oxidation, silicon reduction and aluminum use

EARLY in the history of electric furnace operation in steel foundries, it was found that if the deoxidizing period were shortened and the steel tapped while the slag was somewhat brown in color, it was possible to shank the metal into quite small castings. When the refining period was cut short in this way, however, not much sulphur was eliminated from the charge, and therefore it was necessary to melt only low-phosphorus scrap, since that is the only grade low enough in sulphur to produce satisfactory steel by this method.

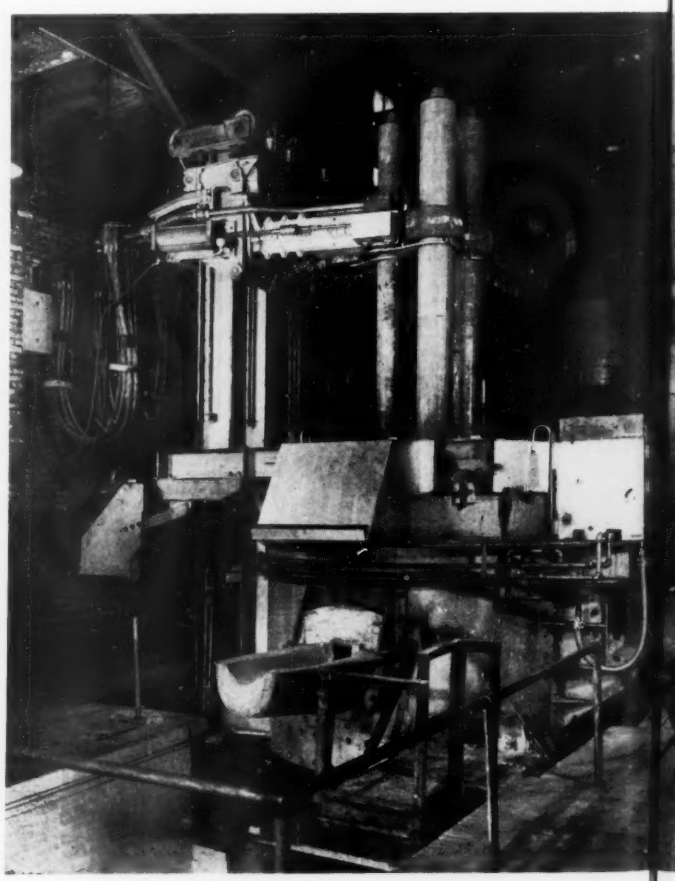
With a low-phosphorus charge, "slagging off" to eliminate phosphorus was no longer necessary, of course, and reducing conditions could be established as soon as the boil had subsided. Since low-phosphorus scrap is readily obtainable in most areas where steel foundries operate, this "single slag" basic process was soon adopted in a number of shops.

In making steel by this process, the method of charging and the average size of scrap used are the same as in "two-slag" operation. As there is seldom enough rust on the scrap to produce the vigorous boil required to wash dissolved gases out of the bath, low-phosphorus iron ore or mill scale is charged as soon as the steel is all melted, and the boil is maintained for the usual 15 or 20 minutes. The composition of the charge is preferably such that at the end of the boil, the carbon is only a little below that desired in the finished metal.

When the boil has subsided, extra lime is shoveled in to thicken the slag, and additions of pulverized coke are made in the same way as in two-slag operation. The deoxidation of the slag and metal, however, is carried only to the point where the slag turns brown. The heat is then "blocked" with ferrosilicon or ferromanganese, and the final additions to adjust the composition of the steel are made. When small tests poured with the spoon set "flat" in the mold, and the steel in the spoon remains liquid for the proper length of time, the furnace is tipped up and its contents poured into the ladle.

The mildly reducing conditions used to partially deoxidize the heat cause any phosphorus absorbed by the slag as P_2O_5 to be reduced to phosphorus and reenter the steel. In one-slag operation, therefore, no phosphorus is eliminated from the bath. The sulphur content is somewhat lowered, but really effective elimination of sulphur can be secured only by prolonging the refining period so much that the fluidity of the steel is greatly reduced. In this method, therefore, little effort is made to lower the sulphur content.

Table II shows the details of handling a one-slag basic heat, in which deoxidation was continued until a carbide slag was produced, which crumbled to powder when cooled. This heat, like that of the two-slag illustrated in Table I (May issue), was melted down quite low in carbon, and not boiled in accord-



Steel melting furnace with hooding to carry away any smoke or fumes. Top charging bucket at rear. Photo courtesy Swindell-Dressler Corp., Pittsburgh

TABLE II—Log of 8000-lb Fully Deoxidized One-Slag Basic Heat

Charge

Purchased low-phos scrap	5000 lb
Foundry scrap	3000
	8000 lb

Time

3:30 Power on—high tap
4:00 Lime 50#
4:30 Lime 50#
5:00 Lime 75#
5:30 Lime 50#
5:45 Melted—Test No. 1: C 0.12, Mn 0.13, P 0.038
5:50 80% ferromanganese 40 lb
5:55 Washed metal 230 lb (3.5% C)
5:58 Power on low tap,
Pulverized carbon 10 lb
6:05 Fluorspar 25 lb
Pulverized carbon 10 lb
6:15 Test No. 2: C 0.20, Mn 0.45
Pulverized carbon 5 lb
6:20 Slag test, strong acetylene odor
6:25 Pulverized carbon 5 lb
6:27 Slag test, crumbles to powder
6:30 Washed metal 90 lb
6:35 80% ferromanganese 11 lb
50% ferrosilicon 60 lb
6:43 Tap

Analysis

C	Mn	Si	P	S
0.25	0.62	0.30	0.035	0.020

Time of heat 3 hr 13 min.

Briggs, *The Metallurgy of Steel Castings*, page 50.

TABLE III—Log of 5000-lb Acid Heat, Complete Oxidation Practice

Charge

Low-phos	Plate Scrap	1250 lb
	Punchings	1000
	Baled scrap	750
	Foundry scrap	2000
		5000 lb

Time

8:00 Finished charging, power on high tap
9:08 Melted—Test No. 1: C 0.22, Mn 0.26, Si 0.16
9:10 Iron ore 200 lb
9:20 Test No. 2: C 0.16
9:30 Test No. 3: C 0.12, Mn 0.07, Si 0.04
Low-silicon pig 100 lb
9:33 Lime 10 lb
Sand 50 lb
9:38 Low-silicon pig 100 lb
9:42 Test No. 4: C 0.21
9:50 50% ferrosilicon 40 lb
9:52 80% ferromanganese 50 lb
9:55 Tap
5 lb aluminum in ladle.

Analysis

C	Mn	Si
0.27	0.69	0.35

Time of heat 1 hr. 55 min.

Briggs, *The Metallurgy of Steel Castings*, page 98.

ance with usual practice, as described previously. Immediately after the charge was melted, the manganese was raised by an addition of ferroalloy, and the carbon was built up with washed metal. This material, formerly much used in the manufacture of high-grade steel, was produced from pig iron by a special process which oxidized out most of the manganese and silicon and a large part of the phosphorus, so that it consisted chiefly of iron and carbon. Today either low-silicon pig iron or crushed electrodes or other carbonaceous material, would be used as a source of carbon. Had the deoxidation of the heat been carried only far enough to give a light brown slag, the time consumed would have been about 2½ hours.

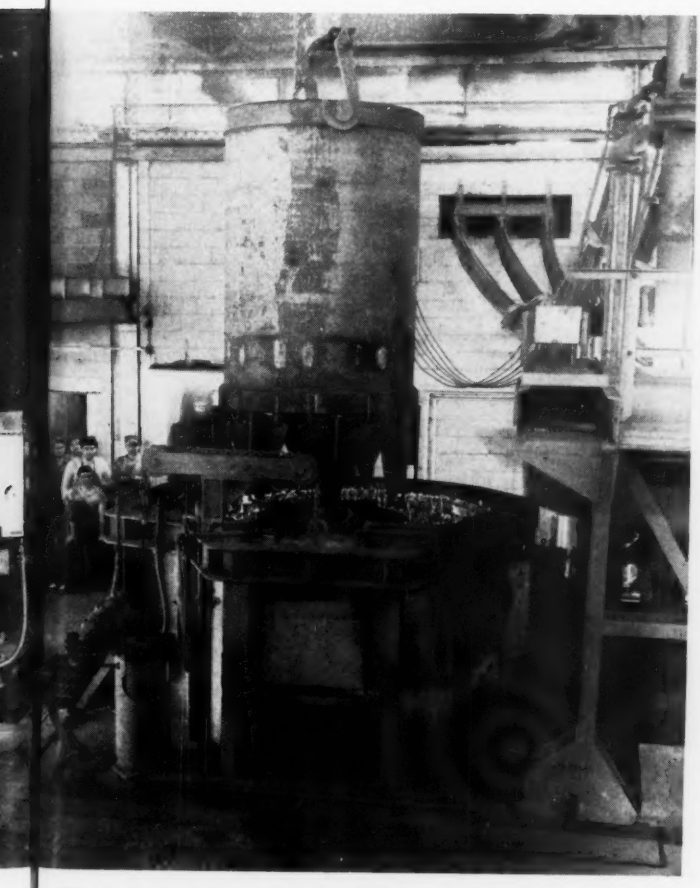


Illustration shows top charging method with bucket in position after the charge has dropped into the furnace. Photo American Bridge Division, Pittsburgh

In the past few years, a further modification of the one-slag basic process, in which the reducing period is practically eliminated, has been adopted in some shops[2]. In this method of operation, an attempt is made to create in the electric furnace the same conditions that exist in the basic open hearth. A charge is used that contains enough carbon to permit a vigorous boil, and a slag containing a high proportion of CaO is established as soon as possible after the heat is melted. Iron ore is charged in sufficient amount to maintain an active boil for 15 or 20 minutes, as in regular methods of electric furnace operation.

As soon as the boil subsides, further elimination of carbon from the bath is stopped by a blocking addition of ferrosilicon or silicomanganese. The carbon, silicon and manganese contents are adjusted by suitable alloy additions, the metal brought quickly to temperature, and the heat poured into the ladle. If necessary, ferrosilicon is tossed into the stream to bring the silicon content to the desired point. As in open-hearth operation, the added silicon and manganese, rather than deoxidation in the furnace by additions to the slag, are relied upon to reduce the oxide content of the metal to such a point that it will not react with the carbon and evolve CO as the steel cools.

The slag in this process will hold some P_2O_5 in solution, just as an open-hearth slag does, and there is also a certain amount of sulphur absorbed as CaS. The method, in short, is identical with basic open-hearth operation, except (*Please turn to page* 276)

QUESTIONS

Iron Not Completely Dissolved

Q.—We are sending you a specimen of manganese bronze from one of our recent heats which shows white magnetic segregation—a trouble encountered on our last four melts which seems to reduce considerably the elongation. It should be 20 per cent in 2 in., but falls as low as 8 per cent. Tensile strength and yield point are always over 90,000 and 45,000 psi, respectively. Composition shows 60 to 68 per cent Cu, 2 to 4 per cent Fe, 3 to 7.5 per cent Al, 2.5 to 5.0 per cent Mn, 0.20 per cent max. Pb, 0.20 per cent max. Sn, and remainder Zn. We melt the metal in three 1200-lb silicon carbide crucibles heated with oxyacetylene gas, and then transfer to one big ladle for pouring the casting.

A.—The "white magnetic segregation" you mention, and which plainly is visible at the fracture in the portion of the test specimen submitted for examination, is a thin piece of steel. You do not mention whether you are using purchased ingot as the raw material, or using copper, zinc, steel clippings, etc. If it is the latter procedure, you are not getting all the iron into solution, or if you are using purchased ingot, then the maker is having the same trouble.

Possibly those inclusions might come from rusty or scaly iron or steel rods or bars used for stirring, but that seems a little far fetched. You do not mention whether you have examined the castings and found the same bright, metallic inclusions, but we suspect that they are present. Of course, it is possible that through careless skimming, the inclusions occur only in the test specimens, but that again does not seem plausible since such carelessness would extend all along the line.

Blades Crack off Propeller Hub

Q.—We have a problem in casting steel propellers in that the blades crack off the hubs, and apparently a hot tear is occurring in that area. If you have any information on how the trouble might be eliminated, we would like to have it.

A.—Blades tearing off the hub of a propeller is due to inability to contract freely toward the hub. That might be caused by extra heavy pop-offs placed at the ends of the blades, or possibly a gate so placed and combined with an extra hard rammed mold. Gate, of course, should be at the hub, and not at the end of the blade. Even very heavy fins at the ends of the blades due to a bad fit between cope and drag might cause the trouble if the mold is rammed extra hard.

Hence, you should see to it that there are no obstructions to free contraction of the blades. It also will help if brackets are cut at the junction of blades and hubs. Fairly heavy chills at the same points would aid since they would "set up" the metal at this heavy section before contraction had progressed far enough to put much strain on the blades. We are assuming, of course, that the steel is of such composition that there is no extra tendency toward hot tearing. High sulphur makes hot tearing probable, and tin above 0.04 per cent will also give the same trouble.

Wants Data on Permanent Molds

Q.—We would like to obtain information on the life expectancy of permanent molds, their repair and maintenance problems with regard to aluminum castings. We will appreciate any information you may have on these questions or any suggestions you may have to offer as to where we may obtain this information.

A.—Consensus on mold life is that it will vary considerably, and largely is dependent upon the design of the gating system and point of impingement of the metal stream on the casting cavity. In general, molds for simple castings will have a longer life than those for intricate castings. Hence, it is possible that one mold may produce only a few thousand castings while another may serve for over 100,000.

Vickers points out in the February, 1945 issue of FOUNDRY that nothing should be left to chance on mold use in the foundry. Previous to service, standard procedure must be developed on the type of mold coating to be used and its application, on the pouring temperature of the metal, the temperature of the mold, the method of pouring, and the production time cycle. Neglect of any of those will lead to shortening of mold life and, in some cases, a premature failure.

Possibility of repair of a mold will rest largely on the location of the defective area, its extent and nature. In some cases where metal impingement has eroded or roughened the surface to a slight degree, the faulty section may be smoothed by grinding. Where a small crack or two is involved, it may be possible to gouge them out sufficiently to apply suitable weld rod filler, and machine to the proper contour. In still other cases the defective area may be tooled out and an insert of the same material as the mold put in place. In some instances it may be possible to make the mold so that sections may be removed and replaced when necessary.

Maintenance will depend primarily on the complexity of the mold. Essential point in maintenance is to set up regular inspection schedules which will vary

and Answers

with the complexity of the mold. In that way proper lubrication, for example, is insured, and slight adjustments to operating mechanisms can be made to prevent breakdowns.

The only source of additional information on the various questions you raise would be foundries operating permanent mold departments, and firms engaged commercially in design and manufacture of such molds for customers.

Cores for an Aluminum Casting

Q.—We are preparing to make a worm gear housing in aluminum which requires two cores. One is 1½ in. in diam and 7 in. long, and the other is 4 in. in diam and 3 in. long. We have never made any aluminum castings requiring cores so would like complete information on a suitable core mixture, temperature of baking and length of time.

A.—For your cores you will have to obtain some clay-free sand known generally as core sand but in some localities termed beach sand. A suitable mixture for the cores you mention would be composed of 125 lb sand, 1 lb cereal, 1 pt linseed-base core oil, 2½ qt water and ½-pt kerosene. Preferably the dry sand and cereal should be well mixed together, then the water added and mixed again, and then the oil and kerosene. If you have only this single job to make you might try using beach or core sand mixed with flour—say about 1 part flour to 10 parts sand. Cores should be baked at a temperature of around 450°F, and they should be baked through in about 1 hour. It also should be mentioned that urea formaldehyde can be used as a binding agent.

Put More Copper in the Mixture

Q.—We should like to improve the appearance of many of our small castings made from the 85-5-5-5 alloy. We have tried several acid dips, which cleaned the castings but did not brighten the skin. We are forwarding one of the castings, also one from a competitor. Quite a contrast between the dull skin on one and the bright skin on the other. We are wondering if the second casting is made from ounce metal. We clean our castings in a cabinet with steel grit, and in a tumbling barrel.

A.—Basing an opinion on the appearance of the two castings submitted for examination we should say you will find an immediate answer to your problem by increasing the copper content in the crucible charge. Your competitor's casting looks like 85-5-5-5 metal, but your casting definitely does not. Incidentally, ounces metal is just another name for the familiar 85 three 5's alloy.

From a utilitarian standpoint one casting is just as good as the other, but if the customer insists on the richer color, acid dips and nonferrous shot blasting—singly or in combination—will not serve your purpose. The dip or the blasting will impart some temporary brightness, but the pale yellow in your casting will appear on all machined surfaces. The customer naturally will shy away from a casting in which the desired color is only skin deep.

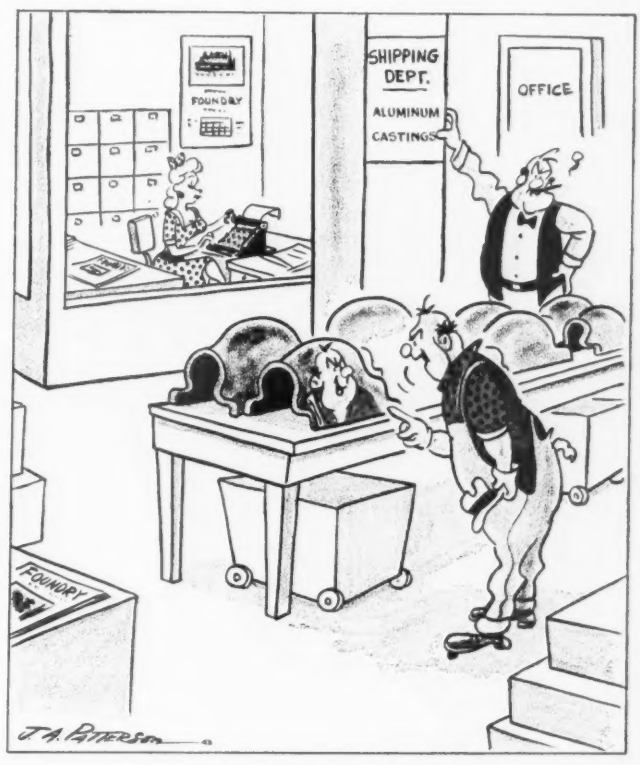
We suggest you have an analysis made of the bright casting and then duplicate it in the crucible mixture. It is not a difficult problem making up a mixture with all new metal, but to use a great deal of miscellaneous scrap in the charge requires wide experience.

Coloring of Bronze Castings

Q.—We are making bronze grave markers, and would like to know how we can give them an oxidized finish quickly.

A.—Material most commonly used to provide an oxidized or brownish finish on bronze is a solution of ammonium polysulphide in water. Ammonium polysulphide is a liquid which may be obtained from chemical or electroplating supply houses. Desired color is obtained by immersing the object in the solution until the proper shade—from a light brown to almost black—is obtained. Dilute solutions are preferable to strong ones as the color obtained is more dense and

GANGWAY! By J. A. PATTERSON



"You got personality—you got looks—you got everything—now go on in there and ask her for a date!"

adherent. You will have to experiment to determine the amount of polysulphide to be added to the water to suit your requirements. Warm solutions give a quicker color than cold solutions. Wet or dry scratch brushing should be used to insure a good adhering coat of color.

Zinc Fumes Cause Brass Chills

Q.—In our foundry producing brass castings a number of our employees have become ill with what we call "brass chills," and we wonder if there is any kind of medicine which would relieve this sickness.

A.—Brass chills, zinc shakes and fume fever are terms commonly used to describe the effect of finely divided zinc oxide fumes on the human system. It is characterized by one or more symptoms, such as stomach cramps, chills, trembling, fever, nauseation, muscular weakness, etc. Remedy, of course, is to remove the cause—the zinc fumes—by adequate ventilation or by providing each employee a lightweight respirator to filter out the offending material.

This type of illness is more prevalent when stagnant or static atmospheric conditions exist—that is, air movement is slight, if any, or the air current seems to move downward. Such conditions prevent the natural upward movement of air current that provide natural ventilation, consequently smoke or fumes remain in the room. Also, the illness is more prevalent on Monday or Tuesday because the employee probably builds up a temporary immunization which disappears over the week-end when he is not exposed to the fumes.

In the average brass foundry it is not too difficult to install suitable hoods with positive exhaust over the furnaces to remove the fumes, but since pouring is not confined to a definite area, ventilation in the foundry is more difficult. Roof exhaust fans may help, provided the air current movement is not confined to the upper areas of the shop but also affects the breathing level where it is desired.

We know of no remedy that will prevent the attack of this illness except removal from exposure.

Desires Skim Gate Information

Q.—In FOUNDRY occasionally we see references to skim gates, perforated pieces of tin or thin perforated cores. In our country we cannot find out anything about these devices. We shall appreciate information on where and how they are used.

A.—Metal skim gates are small perforated pieces of thin steel which have been tin plated to prevent the formation of rust. The device rests in the bottom of the pouring basin directly over the sprue. When metal is poured into the outer end of the pouring basin and then runs over to the sprue opening, the skimmer holds it for a moment and thus produces a small pool in which any slag or foreign material floats to the top instead of flowing down into the sprue.

The perforated core, which may be placed at any one of several points in the passage between the top of the sprue and the gate entrance to the casting, acts as a skimmer and also serves to break the force of the metal stream. In some instances both the metal skim gate and the perforated core are used in the same mold. In other instances two or more perforated cores may be set at different places in the runner and gate passage.

Skimming devices are used extensively in molds for light and medium weight castings which must be absolutely clean inside and outside. Based on the general idea of preventing the entrance of foreign material, some foundrymen place a tapered cast iron plug covered with blacking in the top of the sprue. The plug remains in place until the pouring basin is filled with metal. Then it is removed by inserting the end of a small steel rod into an eye on top of a rod extending upward from the plug. These plugs are kept warm and dry and last indefinitely.

Melt Iron Charges in Crucible

Q.—Occasionally we make a few gray iron castings. Since we have no cupola we melt the metal in a crucible in one of our brass melting furnaces. We charge the crucible with gates and sprues from former heats and put a few pieces of broken pig iron on top. We have no trouble in securing hot iron, but the castings are too hard. We shall appreciate information on how to produce soft machinable castings.

A.—Charge your scrap and pig iron according to your present custom, but place charcoal layers between the iron layers. Sufficient charcoal should be added so that some remains on top after all the iron is melted. With a fair grade of scrap and about 25 per cent No. 1 pig iron you can produce a soft machinable iron for the castings. If a small test indicates that the iron is hard, it may be softened by the addition of a small amount of ferrosilicon.

Core Oil Difficult To Obtain

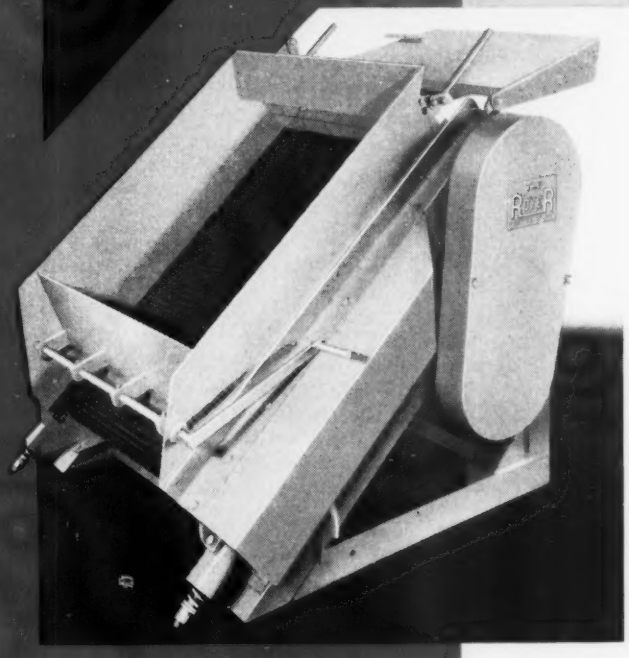
Q.—Before the Spanish war we used an imported core oil in two grades—one for hot and one for cold. Now we cannot obtain in Spain a good core oil for our coreblowers due to difficulties in importation. Can you supply us with a good formula to make our own core oil? We think that that oil previously mentioned had fuel oil as its principal component.

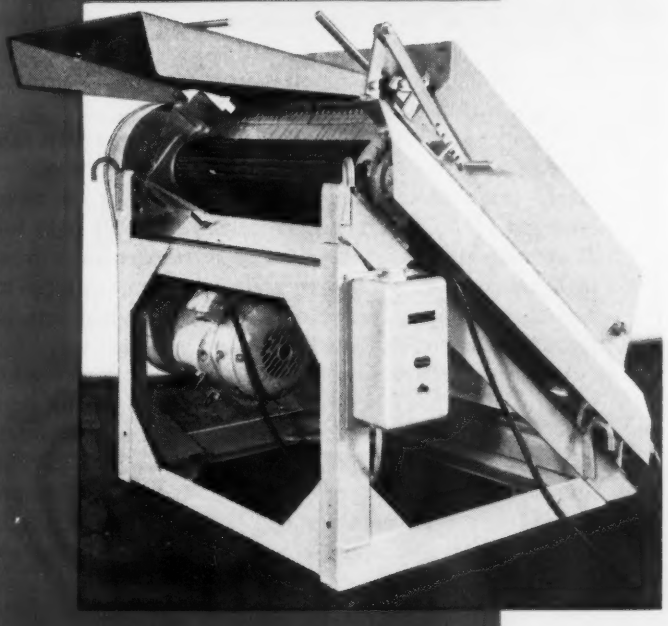
A.—If you can obtain a good quality of linseed oil, you could formulate your own core oil by addition of pine rosin (colophony) and kerosene or fuel oil. One suggested mixture is 42.5 to 45 per cent linseed oil, 27.5 to 30 per cent gum rosin and 25 to 27.5 per cent water-white, acid-free, 150°F flash point, kerosene. Another is 38.7 to 48.7 per cent linseed oil, 39.7 to

(*Concluded on page* 138)

NOW AVAILABLE

60 to 100 Tons
of conditioned sand PER HOUR
with the new ROYER Model "NYS"





The new Model "NYS" Royer Sand Separator and Blender was designed to handle the discharge from large mullers or for installation in sand handling systems having a conditioned sand requirement of 60 tons per hour or more. This model "NYS" Royer, the latest in the complete line of Royer sand preparation equipment, with its capacity of 60 to 100 tons of sand per hour (depending upon the type and temper of the sand to be conditioned) is the answer to the many demands we have received from Royer users for a machine of larger capacity.

The new Model "NYS", like all Royer Sand Separators and Blenders, gives foundrymen complete 6-point sand preparation: refuse removal, thorough blending and mixing, lump breaking, increased permeability, even moisture distribution and double aeration.

Its sturdy construction with heavy welded underframe and base is assurance of many years of continuous service under the most abusive operating conditions. Write for complete details on this latest labor saving, production increasing unit.

SPECIFICATIONS

Capacity	60 to 100 tons per hour depending upon type and temper of sand	
Overall Dimensions	Length:	54"
	Width:	56"
	Height:	54"
	Belt Width:	36"
Approximate Weight	2000 pounds	
Power	10 horsepower	
Construction	Heavy welded angle frame and base	

ROYER

FOREMOST IN SAND CONDITIONING EQUIPMENT

ROYER FOUNDRY & MACHINE CO.

159 PRINGLE ST., KINGSTON, PA.

QUESTIONS and Answers

(*Concluded from page* 136)

35.1 per cent crude oil, and 21.6 to 16.2 per cent rosin.

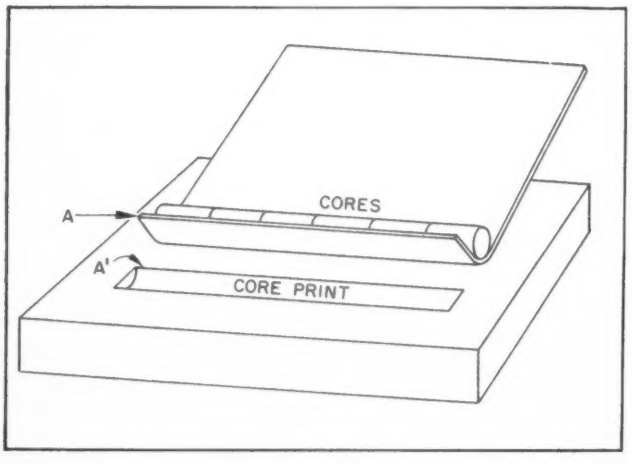
Method of compounding is to melt the rosin by a steam coil in the container, add the kerosene or fuel oil, stir thoroughly, and then add the linseed oil. The rosin acts as a binder in its own right, and the kerosene or fuel oil is a straight diluent acting as a carrier to spread the oil and rosin. Other oils, such as soya bean, perilla, chinawood, sardine, menhaden, corn, polymerized mineral, etc., might be used in part for some of the linseed oil.

Your reference to oil for use in hot times and cold times, we assume, refers to summer and winter conditions, and we suspect that the winter grade probably contained more diluent that the summer grade so that it would flow more readily. However, to obtain the same physical properties in the cores, more of the winter grade would have to be used with a given amount of sand so that the binder content would be the same.

Rig Sets Small Cores Rapidly

Q.—Several years ago we read a description of a rapid method for setting large numbers of small cores in the molds made in a prominent nonferrous foundry. At the time we were not particularly interested. Now that we are in a position where the information would be an asset, we find that we have forgotten the details.

A.—In the method to which you refer the cope half of the flask is placed on the pattern plate and filled with plaster or other similar material. After the material has set it serves as a match or follow board in which the cores are placed by the molder, or by an unskilled helper serving two or more molders. The molder lifts his drag from the bench or molding machine and places it face down on the plaster half mold containing the cores. The assembly then is rolled over and the plaster mold lifted off and placed face up on the bench ready to receive the next batch of cores. No skill is required in setting the cores. The core prints are not disturbed and the cores fit accurately.



When the sheet metal carrier is tipped forward the cores roll quickly into the core print

You may be interested in a core setting method practiced in a malleable iron foundry where the principal product is industrial chain links in almost infinite variety. Each link requires a small cylindrical core to form the hook at the end of the link casting. The required cores are placed in the curved end of a piece of sheet metal, as shown in the accompanying illustration. The loaded carrier is lifted and placed on the joint face of the drag and adjusted in such a manner that the edge *A* on the carrier coincides with the edge *A'* on the core print in the drag. When the upright part of the carrier is tipped forward, the cores roll accurately and quickly into the core print in the drag.

Aluminum Additions to Cast Iron

Q.—In a discussion of cupola charges in the March issue, page 148, it is stated: "Additionally and for all operations, no nonferrous metal, particularly aluminum, should be charged." What is there about aluminum that is so objectionable? In the steel industry it is used as a deoxidizer, and we always have felt that small amounts, say about 0.10 per cent, are advantageous in cast iron to remove oxygen and prevent blowholes.

A.—It is doubtful that small additions of aluminum to an ordinary cupola charge would make any perceptible difference one way or another. In the first place it would burn and be slagged off if added to the cupola charge as aluminum or high aluminum alloy. In the second place it never has been shown (to the best of our knowledge) that additions within 0.10 per cent added directly to molten iron have a noteworthy or even perceptible effect.

In one foundry molten gray iron (steel scrap mix) is regularly mixed with molten, aluminum-deoxidized steel. Amount of aluminum so added is in the neighborhood of 0.02 per cent in terms of total iron mix. That material far surpasses high-steel cupola mixes in freedom from shrinkage and pinhole porosity. When non-aluminum-treated steel is added, shrinkage defects have been found to be severe.

When considerable amounts of aluminum are added (1 to 4 per cent), graphitization occurs in the liquid iron with heavy kish formation. The metal is worthless for casting purposes. Just where the dividing line between "good" and "bad" effects of aluminum is, has not been established. It probably varies according to the composition of the iron, melting conditions, etc.

It should be noted that in electric furnace melting (direct and indirect arc) of austenitic cast iron, traces of tin and/or lead are unbelievably detrimental. A few hundreths of one per cent of either can make the metal weak and with no deflection. Strangely enough, fractures look clear.

PROGRESS REPORTS FAVOR EXTENDED USE OF NATIONAL CARBON IN BLAST FURNACES

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● The future of "National" carbon as a preferred material for blast furnace linings is definitely assured by the mounting evidence of its extra long life in hearths and, more recently, in side walls all the way up to the mantle.

Already, indications are that, as carbon goes *up* the furnace, operating costs come *down*. Fewer shut-downs, more uniform casts are consistently being obtained in existing installations. And increased capacity can be expected to result from the use of thinner wall sections, made possible by this ideal furnace-lining material.

Furnace operators are urged to keep their eyes on carbon and on the growing body of data covering its use in modern, high-tonnage-life furnaces.

WHY BUY THIS ITEM?

It gives you *double the usable light!*
No metal can to *leak or corrode!*
It can't *stick, swell or jam!*
It delivers the *whitest, brightest light!*

It's the "Eveready" No. 1050 flashlight battery, made with the zinc electrode inside a carbon jacket – just the reverse of every other battery on the market.

Test it and . . . you always buy it!

OTHER NATIONAL CARBON PRODUCTS

BLAST FURNACE LININGS • BRICK • CINDER NOTCH LINERS • CINDER NOTCH PLUGS • SKIMMER BLOCKS • SPLASH PLATES • RUNOUT TROUGH LINERS • MOLD PLUGS • TANK HEATERS

MEN of Industry

DR. PAUL D. MERICA, formerly executive vice president, has been named president of International Nickel Co. of Canada Ltd., and its subsidiary, International Nickel Co., New York. **Dr. John F. Thompson,** retiring president, continues as chairman of the board. Other changes in the New York subsidiary company include **Walter C. Kerrigan,** vice president, who has become vice president-general manager; **L. R. Larson,** named assistant vice president-assistant general sales manager, and **Theodore H. Dauchy, Richard A. Cabell** and **John A. Marsh,** appointed assistant vice presidents. Dr. Merica became associated with the company in 1919, becoming director of research and subsequently assistant manager of the Development and Research Department. He was named assistant to the president in 1932, a director in 1934, vice president in 1936, and executive vice president in 1949.

♦ ♦ ♦

A. M. Ondreyco, formerly plant manager, Vulcan Foundry Co., Oakland, Calif., has joined General Metals Corp., San Francisco with headquarters at its Metals Division in Oakland. Mr. Ondreyco studied chemistry at Carnegie Institute of Technology and completed a special foundry apprenticeship at Westinghouse Air Brake Co., Wilmerding, Pa., where he became operating metallurgist. He later joined Meehanite Metal Corp., and was a foundry engineer, designer and metallurgist in the United States, Australia and Canada. Following this he was associated with Cooper-Bessemer Corp., Grove City, Pa. Mr. Ondreyco, one of the organizers and a former president of Northern California Chapter of the AFS, is a national director of the AFS.

♦ ♦ ♦

Claude S. Lawson has been elected president, and **James J. Reynolds** has been made vice president, U. S. Pipe & Foundry Co., Burlington, N. J. Mr. Lawson succeeds **Norman F. S. Russell** who has been re-elected chairman of the board, relinquishing the office of president which he has filled since the resignation of Gen. Donald Armstrong in December. Since 1948 Mr. Lawson has been president of Sloss-Sheffield Steel & Iron Co., Birmingham, U. S. Pipe & Foundry Co. subsidiary, which he joined in 1915 as a chemist following graduation from Clemson College. While there he was blast furnace superintendent, general manager, vice president, president and a director. He became a director of U. S. Pipe & Foundry Co. last year. Mr. Reynolds has been assistant to the chairman of the board since the beginning of this year, after serving 5½ years with the National Labor Relations Board.

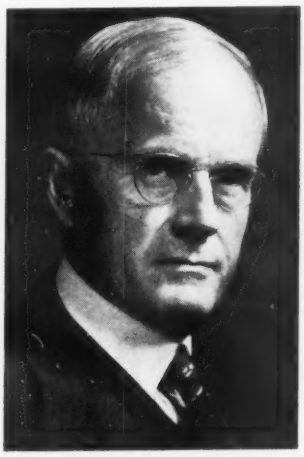
♦ ♦ ♦

N. R. Knox, since 1943 president, Bucyrus-Erie Co., Milwaukee, has become vice chairman of the board. **W. L. Litle** has succeeded Mr. Knox as president and **W. W. Coleman** was re-elected chairman. **J. G. Miller,** with the company 44 years and until recently secretary-treasurer, has resigned and **L. C. Cline,** comptroller, has become secretary. **F. C. Weiblen,** assistant treasurer, was named treasurer. **P. H. Birckhead,** vice president-sales, was elected a director, succeeding **D. P. Eells,** who retired after 45 years with the company. All other officers and directors were re-elected.

♦ ♦ ♦

Morse G. Dial has been elected president, Union Carbide & Carbon Corp., New York, succeeding **Fred H. Haggerson** who continues as chairman of the board. **Walter E. Remmers** has been named vice president of the company's Alloys Division. Mr. Dial, a graduate of Cornell University, was elected executive vice president of Union Carbide in 1951. He joined the corporation in 1929, became secretary-treasurer in 1945, vice president and director in 1949 and a member of the executive committee

(*Continued on page* 142)



DR. PAUL D. MERICA
. . . Inco president

A. M. ONDREYCO
. . . joins General Metals

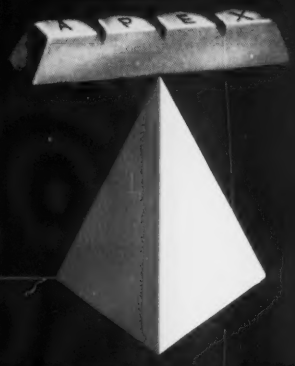
CLAUDE S. LAWSON
. . . heads U. S. Pipe

JAMES J. REYNOLDS
. . . v.p., U. S. Pipe

APEX

aluminum
magnesium
zinc
alloy ingot

symbol of quality



Research leadership back of every Ingot

CHICAGO • CLEVELAND • APEX SMELTING CO.

(*Continued from page* 140)

last year. Mr. Remmers joined Union Carbide in 1936, became president of Electro Metallurgical Co. in 1948 and president of United States Vanadium Co. in 1950. Both companies are divisions of Union Carbide & Carbon Corp.

♦ ♦ ♦

Edward C. Eizember, chief inspector at the Peerless and Superior plants of Wellman Bronze & Aluminum Co., Cleveland, has been appointed superintendent of the Peerless plant. He has been with the company 5 years. **Robert A. Thomas,** formerly superintendent of the Peerless plant, has been named manager of the new Garfield plant, a magnesium foundry scheduled to be in full operation soon. **Benjamin E. Weimer,** formerly in charge of scheduling at the Superior plant, has been appointed director of customer relations with headquarters at the company's new general office. Mr. Weimer has been with the organization 11 years.

♦ ♦ ♦

James T. Towne has been appointed assistant to the vice president, Vanadium Corp. of America, New York. He was formerly administrative assistant to the director of the research and engineering department of the Air Reduction Co., New York.

♦ ♦ ♦

Harry C. Moore, since 1941 vice president, Beloit Iron Works, Beloit, Wis., maker of paper manufacturing machines, has been named president, succeeding **Elbert H. Neese,** president since 1931. Mr. Neese, who joined the company in 1916, will continue in active company management. Other officers were re-elected.

♦ ♦ ♦

Dr. George V. Slottman, who since 1949 has been director of research and engineering, Air Reduction Co., New York, has been elected a vice president. Dr. Slottman was graduated from Massachusetts Institute of Technology in 1925, received his Ph.D. from University of Berlin two years later, when he returned to M.I.T. as a professor of chemical engineering. From 1930 to 1934 he was associated with United Steel Companies Ltd., Sheffield, England joining Airco in 1934. Since that time he has served as manager of the general technical sales department and technical assistant to the vice president.

♦ ♦ ♦

Clarence J. White Sr. was recently appointed coreroom foreman, Grand Rapids Foundry, subsidiary of Oliver Machinery Co., Grand Rapids, Mich. Mr. White was formerly coreroom foreman, Sterling Casting Corp., Bluffton, Ind. Prior to that he spent 35 years in the foundry industry, working at Champion Engineering Co., Kenton, O., Lima Locomotive Works, Lima, O., St. Marys Foundry Co., St. Marys, O., and Cooper-Bessemer Corp, Mt. Vernon, O.

♦ ♦ ♦

John K. Beidler, recently named general manager of the Machinery Division, Dravo Corp., Pittsburgh, and a director and vice president, Dravo-Doyle Co., a company subsidiary there, has been elected a director of Dravo Corp. A graduate of Lehigh University, Mr. Beidler has been associated with Dravo since 1935.

♦ ♦ ♦

Dr. Robert J. Anderson has been appointed head of a new department of metallurgy, Southwest Research Institute, near San Antonio, Tex. Dr. Anderson, who received a doctor of science degree from Massachusetts Institute of Technology, has been consulting metallurgist to numerous industrial companies. The new department will undertake industrial metallurgical research in foundry practice, process and physical metallurgy in addition to metal economics problems.

* * *

Gordon W. Cameron has been named vice president, Aluminum Co. of America, Pittsburgh, in addition to his duties as treasurer, an office he has held since 1943. **Arthur P. Hall,** director of public relations and advertising, has been made vice president in charge of those departments and **C. F. Nagel Jr.,** chief metallurgist, has also been appointed a vice president.

♦ ♦ ♦

Stanley M. Hunter has resigned as vice president-director, American Hoist & Derrick Co., St. Paul. Mr. Hunter joined the sales department of the company in 1936, later becoming general manager of sales, vice president-sales and in 1949 executive vice president. Prior to that for 17 years he was associated with Novo Engine Co., Lansing, Mich.

♦ ♦ ♦

Jeffrey W. Meyer has joined Wilson & George Meyer & Co., San Francisco, following Army Chemical Corps service. A great-grandson of the founder of the company, Mr. Meyer will serve as manager in the San Francisco office, directing sale of industrial chemicals, plastics and foundry coke.

♦ ♦ ♦

Herbert J. Heesch has been appointed field sales supervisor, the Hooker Electrochemical Co., with headquarters in Niagara Falls. Mr. Heesch will co-ordinate activities of field salesmen and district sales managers in his new position.

* * *

Dr. Leonard Greenburg, director of the Division of Industrial Hygiene and Safety Standards, New York

(*Continued on page* 144)

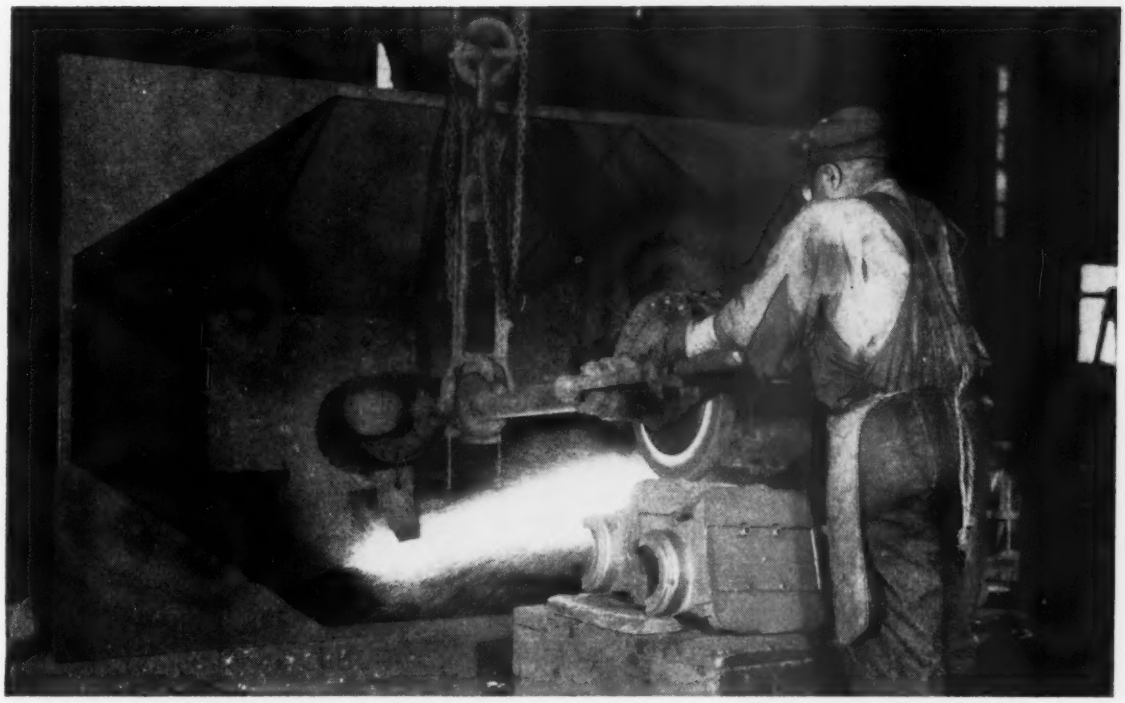
EDWARD C. EIZEMBER
. . . Wellman plant supt.

ROBERT A. THOMAS
. . . plant mgr., Wellman

BENJAMIN E. WEIMER
. . . Wellman Bronze exec.

JAMES T. TOWNE
. . . joins Vanadium Corp.

today's best buy is better air!



ROTO-CLONE makes a dust storm disappear for keeps

Swing frame grinder dust can now be controlled effectively—economically

THIS close-up photo of a swing frame grinder in operation tells the story of ROTO-CLONE* dust control better than words. Here's one of the worst offenders when it comes to producing dust, yet the surrounding atmosphere is clear and clean. It's the Type D ROTO-CLONE that does this job so effectively—and its advantages are many:

1. Constant Efficiency in dust separation under all operating conditions.

2. Uniform Air Volume, assuring proper suction at hoods and unvarying air velocities in pipe lines.

3. Small Space Requirement—functions of exhauster and separator combined in compact, self-contained unit.

4. Low Cost of System—ROTO-CLONE may be located at or near dust source, eliminating long pipes and the expense of outdoor installations.

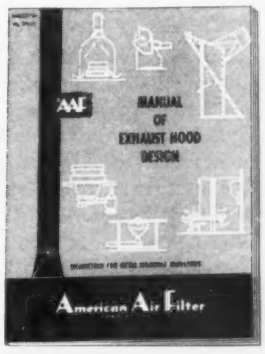
5. Ease of Installation—requires only electrical and piping connections—no complicated parts assembly. May be readily moved to new location if desired.

That's why more grinders are exhausted by Type D ROTO-CLONE than any other type dust collector. And you have the choice of installing this system as a central type with main duct and branch connections or as an individual unit serving a single dust-producing operation. For complete information, call your local AAF representative or write direct to address below.

New! COMPLETE!

"Manual Of Exhaust Hood Design"

Write for Bulletin No. 270-E1



**ROTO-CLONE is the trade-mark (Reg. U. S. Pat. Off.) of the American Air Filter Company, Inc., for various dust collectors of the dynamic precipitator and hydro-static precipitator types.*

AAF American Air Filter
COMPANY, INC.

266 Central Avenue, Louisville 8, Kentucky

American Air Filter of Canada, Ltd., Montreal, P. Q. • Pacific Division Office, San Francisco, California

KENNETH G. HUBACH
. . . B-L-H foundry sales

ANTHONY J. ALLEN
. . . Wall Colomonoy sales

LOUIS M. LUND
. . . A-D-M representative

ROBERT J. PAINTER
. . . treasurer, ASTM

(*Continued from page* 142)
State Department of Labor, was recently given the Cummings Award of the American Industrial Hygiene Association for his work in the field of industrial health and safety.

♦ ♦ ♦

Kenneth G. Hubach, for the past year manager of the commercial weldment division, has been appointed sales manager, Foundry and Commercial Weldment Departments, Baldwin-Lima-Hamilton Corp., Philadelphia, where he will work toward a closely co-ordinated foundry and weldment service. A graduate of Newark College of Engineering, Mr. Hubach later studied at Temple University. Previous connections include Page Steel & Wire Division, American Chain & Cable Corp., Monessen, Pa., and H. L. Yoh Co., Philadelphia.

♦ ♦ ♦

Anthony J. Allen recently joined the Wall Colmonoy Corp., Detroit, as eastern sales manager, with headquarters in New York. Mr. Allen is a graduate of Boston University and Armour Institute of Technology and until recently was a sales engineer and sales manager in the metalworking industry.

♦ ♦ ♦

Louis M. Lund has been named sales representative in the northeastern Ohio area for Foundry Products Division, Archer-Daniels-Midland Co., Cleveland. Mr. Lund was graduated from University of Minnesota in 1950 and joined the company at that time as a research engineer.

♦ ♦ ♦

John K. Rittenhouse, since 1946 treasurer of American Society for Testing Materials, has retired after 43 years of service. Mr. Rittenhouse was the first full-time employee of the society, which he joined in 1909. He was closely associated with its first secretary, Dr. Edgar Marburg, acting as assistant treasurer until 1946. **Robert J. Painter** has succeeded Mr. Rittenhouse as new treasurer of the society and **Dorothy P. Douty** has been named assistant treasurer. Following graduation from Rensselaer Polytechnic Institute, Mr. Painter taught there for a period and later was associated with Bethlehem Steel Co., joining the ASTM staff in 1931. He will continue as assistant secretary, which he became in 1946, and as associate editor of the ASTM *Bulletin*.

♦ ♦ ♦

Richard Smith of Indianapolis has been named president, Jet Combustion Inc., Chicago, succeeding the late John E. Tegarden, president and founder. **Mrs. John Tegarden** has been made executive vice president, **Richard Kelly,** vice president-engineering, **Stephen Kupres,** vice president-field operations, and **Clyde Tegarden,** secretary-treasurer of the company, which designs and builds industrial furnaces and equipment.

♦ ♦ ♦

George W. Edwards, until recently with the sales department, Basic Refractories Inc., Cleveland, has been named service manager of the company's special service division. **Charles R. Heilig** has been named senior sales engineer of Basic's central district covering Ohio, Pennsylvania, Kentucky and West Virginia. He joined the company in 1944.

♦ ♦ ♦

William A. Casler, assistant director of research, has been named manager of program development, Armour Research Foundation, Illinois Institute of Technology. Mr. Casler, a graduate of University of Oklahoma, joined the foundation staff 6 years ago as a research engineer, following 4 years in that capacity at Caterpillar Tractor Co., Peoria, Ill. He has been assistant director of research since 1949.

♦ ♦ ♦

Maj. Gen. Frederick R. Dent Jr., recently commanding general of the Wright Air Development Center, Dayton, O., has become a military director for production and requirements of the Department of Defense Munitions Board, Washington. Gen. Dent succeeds **Maj. Gen. F. H. Griswold,** who has become commanding general of the Third Air Force, U. S. Air Forces in Europe. A graduate of U. S. Military Academy, St. Mary's University, Massachusetts Institute of Technology and Harvard University, Gen. Dent's responsibilities will include priorities and controls, industrial security, facilities and services, machine tools and other production equipment, under **Harold R. Austin,** Munitions Board's vice chairman for Production and Requirements. He will also collaborate with civilian agencies and representatives of private industry in these fields.

♦ ♦ ♦

Dr. Henry L. Cox has been elected vice president in charge of the Chemical Division, Corn Products Refining Co., New York, with headquarters in Argo, Ill. A graduate of University of North Carolina and University of Chicago, Dr. Cox joined the Corn Products company in 1944, following association with several food and industrial companies as well as the Mellon Institute.

♦ ♦ ♦

Richard A. Gehr, previously New York district heating specialist, General Electric Co., Schenectady, N. Y., has been appointed sales manager of heaters and devices for its industrial heating department, succeeding **Rob-**

(*Concluded on page* 146)

HERE'S NEWS ON CRUCIBLE FURNACES

Making news today is this ring/cement lining developed by CARBORUNDUM for non-ferrous crucible furnaces. It consists of CARBOFRAX silicon carbide rings, 1½" thick, backed up with 2½", or more, of ALFRAX aluminum oxide cement (used for insulation). Operators say that this lining . . .

GOES IN FASTER. Rings are light enough for one man to handle. No hoist is needed. The cement is handled like Portland cement — just mix with water and pour. A full lining can be installed in a couple of hours over a week-end, and be ready to go Monday.

LASTS LONGER. CARBOFRAX rings make one of the most durable linings known. They are inherently resistant to flame erosion, spalling and cracking, and will go many months with little or no patching. Even really high temperatures won't soften them.

CUTS FUEL COSTS. Since the rings are only 1½" thick, there's ample space left for insulation. Moreover, the ALFRAX cement that backs up the rings is one of the best refractory insulating materials available. It provides a low heat capacity furnace and keeps heat loss to a minimum — hence less fuel is needed to turn out more melts.

GIVES EXTRA HEATS. You'll get fast, uniform heating with these linings, and *consistent* time per heat. One extra heat per day, sometimes two, is quite possible.

Why not check up? It takes just a moment to drop us a line. We'll gladly furnish recommendations to fit your needs. We make lining materials — rings, ring segments, and cements — to fit *every* need. Address Dept. A-62, Refractories Division, The Carborundum Co., Perth Amboy, N. J.

Use furnace linings by

CARBORUNDUM

Trade Mark

for lower cost installation . . . operation . . . maintenance

"Carborundum", "Alfrax", and "Carbofrax" are registered trademarks which indicate manufacture by The Carborundum Co.

(*Concluded from page* 144)

ert W. Kise, recently appointed manager of product planning for that department.

♦ ♦ ♦

John A. Costello has been named representative for George F. Pettinos Inc., Philadelphia, supplier of sand, gravel, refractory and insulating cement. Mr. Costello will represent the company in central and western New York and in the Erie, Pa., district.

♦ ♦ ♦

James L. Ozanne has joined the business staff of FOUNDRY as district representative and assistant to J. F. Ahrens in the New York office. Mr. Ozanne has had several years of experience in the East as advertising sales representative. During World War II Mr. Ozanne was with the U. S. Marine Corp for 4 years and saw considerable active duty in the Pacific theatre.

♦ ♦ ♦

Leo F. Thompson has been named director of industrial relations, the Lunkenheimer Co., Cincinnati. Until recently Mr. Thompson was associate director of industrial relations, Parke, Davis & Co., Detroit. During World War II he was employee relations manager at Wright Aeronautical Corp. plant, Lockland, O.

♦ ♦ ♦

Samuel Zolin has been appointed vice president-treasurer, the Cooper Alloy Foundry Co., Hillside, N. J. Mr. Zolin joined the company in 1927 as a clerk, later becoming bookkeeper, office manager and secretary-treasurer.

♦ ♦ ♦

H. O. Bennett has been appointed Indianapolis district representative for Michigan Oven Co., Detroit, covering parts of Ohio and Kentucky. A graduate of Purdue University, Mr. Bennett was for 5 years process engineer, General Motors Corp., Muncie, Ind., and for 14 years industrial representative, Surface Combustion Corp. **Bruce Hogarth** has been named Philadelphia representative for Michigan Oven. Since graduation from Duke University, Mr. Hogarth has been for 8 years with W. Wirt Young & Associates, Philadelphia, as sales representative for Gehnrich & Gehnrich Inc., Woodside, N. Y., the parent company, Surface Combustion Corp., and its Webster Engineering Division, Tulsa, Okla.

♦ ♦ ♦

William H. Woodward has been named sales manager, Ottawa Silica Co., Ottawa, Ill., succeeding the late E. O. Schneider. Mr. Woodward, who joined the company in 1932, spent 4 years in production and maintenance, three years in the shipping department and 10 years as a salesman. He has been assistant sales manager for 3 years.

♦ ♦ ♦

Harry E. Lewis has been appointed director of the Industrial Mineral Wool Institute. Mr. Lewis, who attended Purdue University, until recently was general manager of the industrial sales department, Perlite Division, Great Lakes Carbon Corp., New York. Previously he had been manager of the insulation engineering department, the Eagle-Picher Sales Co., Cincinnati and also was associated with Owens-Corning Fiberglas Corp., Toledo, O.

♦ ♦ ♦

R. J. Foresman, a director of Mid-West Abrasive Co., Owosso, Mich., has been named vice president-general sales manager in charge of sales, service engineering and advertising. He has been with the company 20 years. All other officers of the company were re-elected.

W. S. SCHAMEL
. . . Wheelabrator technician

W. S. Schamel, formerly sales engineer, has been named assistant technical director, Dust & Fume Control Division, American Wheelabrator & Equipment Corp., Mishawaka, Ind. **G. W. Roper, J. K. Davidson** and **F. A. Lindahl** have been made project engineers. Three additional project engineers have been appointed: **W. G. Carrie,** for the past 25 years with Consolidated Mining & Smelting Co., Trail, B. C.; **W. H. Williamson,** formerly a chemical engineer with Procter & Gamble Co., Cincinnati; **F. R. Culhane,** formerly assistant dust control engineer, Phelps-Dodge Corp., Morenci, Ariz.

♦ ♦ ♦

M. O. Monsler, for the past 2 years sales manager of the Welder and Electrode Division, Harnischfeger Corp., Milwaukee, has been named manager of the division. **W. R. Stephens** has succeeded Mr. Monsler as sales manager of the division. Mr. Stephens, who attended Carnegie Institute of Technology, joined the company in 1947, and has been a welder sales engineer in the Detroit office since that time.

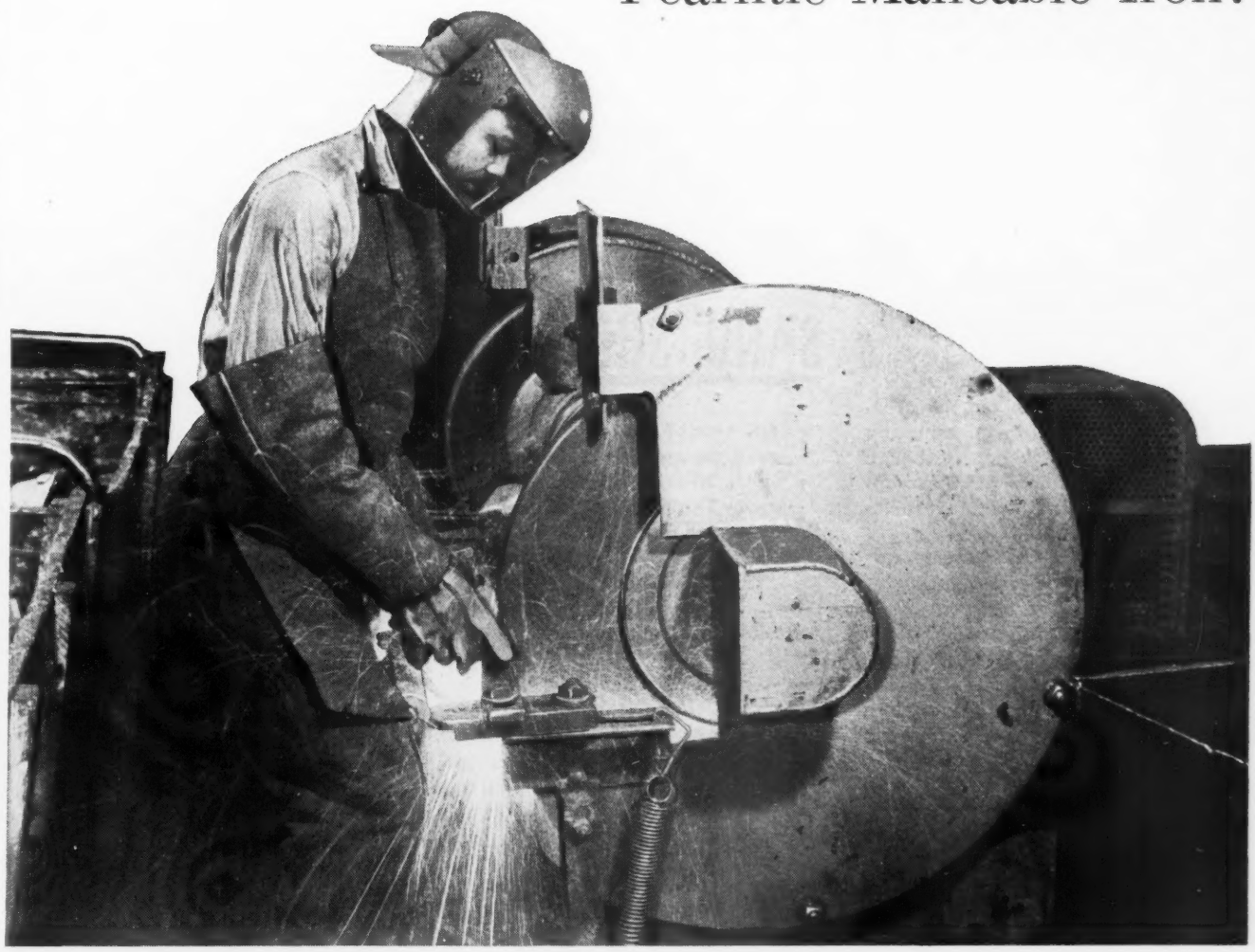
JOHN A. COSTELLO
. . . Geo. F. Pettinos sales

JAMES L. OZANNE
. . . N. Y. FOUNDRY office

LEO F. THOMPSON
. . . joins Lunkenheimer Co.

SAMUEL ZOLIN
. . . Cooper Alloy executive

Why are U. S. Rubber grinding wheels chosen to grind Pearlitic Malleable Iron?



To grind gates from castings of Pearlitic Malleable Iron, the grinding must be done very quickly, at great pressures, so that there is no time for excessive heat to build up. Not only must the wheel cut rapidly and cool but also it should be wear resistant to provide economy. Special tailor-made wheels by United States Rubber Company are the only wheels which this foundry has found suitable for the job.

This is another example of why it can pay you to consult a "U. S." technician about your grinding wheels requirements. Invariably he can help you increase production *and* reduce costs. Write address below.

GRINDING WHEEL INSTITUTE MEMBER

PRODUCTS OF U.S.RUBBER SERVING THROUGH SCIENCE

UNITED STATES RUBBER COMPANY

MECHANICAL GOODS DIVISION · ROCKEFELLER CENTER, NEW YORK 20, N. Y.

International Congress

(*Continued from page* 107)

precedent by permitting all interested to attend.

Shell Molding—Reminiscent of the widespread attention given at the 1949 convention to the then new material nodular iron, was the interest displayed at Atlantic City in the subject of shell molding. This was evidenced by the crowds at Foundry Show booths where shell mold materials and equipment were displayed, and by the overflow audience of approximately 700 who attended the second sand shop course session devoted to shell molding.

R. H. Jacoby, the Key Co., East St. Louis, Ill., and Bernard N. Ames, U. S. Naval Shipyard, Brooklyn, N. Y., presided at the meeting where the subject was discussed by a panel of five.

Consensus of the panel was that, while the shell molding process offers important advantages in producing certain types of castings, it is not adapted to all types of products. Further, an important use for the process appears likely to be in replacing other forms of fabrication, although in numerous instances it will supplant existing forms of sand molding.

H. K. Salzberg, the Borden Co., Bainbridge, N. Y., discussed the types of resins commonly used in shell molding and their properties. He said that different types of resins are available, their selection depending partly on whether the pattern has deep recesses or simple contours. About 5 to 10 seconds is required for the resin to melt and flow into place and 30 to 120 seconds for curing. The time depends on shell thickness desired and temperature employed. It was announced that the AFS is developing test methods to evaluate shell molding properties such as strength, hardness, permeability and hot deformation.

Vaughan C. Reid, City Pattern Foundry & Machine Co., Detroit, pointed out that even though shell molds are more expensive than the conventional sand type, the end product can be cheaper if sufficient machining is eliminated or the number of scrap castings is sufficiently less compared with former practice. He favors use of copper-base material for patterns, to provide best heat conductivity and corrosion resistance.

R. W. Crannell, Lehigh Foundries Inc., Easton, Pa., pointed out that the process may offer better opportunities for use in making cores than molds. As he indicated, it is possible to use shell molds with oil sand cores and shell cores with green or dry sand molds. In one application he described, a shell core involved a material cost 10 per cent less than that of a comparable oil sand core. On the other hand, material costs for molds are considerably higher than those for sand molds. Advantages of shell cores are their dimensional accuracy, smooth surface, high permeability, ease of storing and handling, plus ease of shakeout. A current disadvantage is the inability to blow cores with the sand resin mixture.

Actual operations in production of shell mold castings were described by E. N. Harrison, Econocast, Inc., Chattanooga, Tenn. Mr. Harrison illustrated with slides a turntable machine his company employs in producing shell mold castings. The conventional type tumbler is used to mix the sand and resin.

Metallurgy involved in shell-mold casting was discussed by N. A. Kahn, New York Naval Shipyard, Brooklyn, N. Y. He discussed the effect of backing material on grain and microstructure of the castings produced as well as the effect of shell thickness. Much of Mr. Kahn's remarks are incorporated in the article, of which he is the co-author, starting on page 112 of this issue.

In subsequent discussion it was pointed out that the type of clamping and back-up for the mold shells depends on the hydrostatic head and dimensional accuracy needed. It was indicated that the percentage of resin in the sand mixture has less effect on the finish of the casting produced than does the distribution of the sand grain and the efficiency of the sand-resin mixing. Also, that it is possible to recover the sand for reuse.

SAND SHOP COURSE

THE first of four sand shop course sessions was presided over by W. B. Scott, National Bearing Division, American Brake Shoe Co., Meadville, Pa., chairman, and J. W. Clarke, General Electric Co., Erie, Pa., co-chairman. The meeting was devoted to a discussion of synthetic vs. naturally bonded sand, and was introduced by F. S. Brewster, Harry W. Dietert Co., Detroit. He described in a general way characteristics of all sands used in the foundry either for molds or cores. So far as results are concerned, the speaker claimed, it does not matter whether a foundryman uses synthetic sand or naturally bonded sand.

He was followed by H. H. Fairfield, Wm. Kennedy & Sons Ltd., Owen Sound, Ont., who described in detail a number of experiments conducted to determine to what extent the character and treatment of the sand affects surface appearance of the castings. All the work related to 85-5-5-5 bronze castings. Even where all the factors—mold hardness, permeability, moisture content, grain size—were alike, a variation in the number of jolts was required to secure duplicate results.

C. A. Sanders, American Colloid Co., Chicago, stated that synthetic sand means economy and ease of contol. Mechanism is necessary. Replying to a question from the floor he admitted that synthetic sand dries out more rapidly than naturally bonded sand, therefore is not amenable to patching. However, he said, in cases of that kind the fault lies with the machine and the pattern equipment. A properly made mold should not require any patching.

H. F. Taylor, Massachusetts Institute of Technology, Cambridge, Mass., referred to the fact that, like many foundry features, the terms synthetic and naturally bonded sands are used rather loosely. He went into considerable detail in pinning down points of difference. He thought a better definition would be primary and secondary sand, the first to apply to naturally bonded sand and the second to synthetic sand which really is an artificial product.

High-density molding materials are finding increasing use in the foundry, but to date little publicity has been given their performance. To bring the subject into the open, the third sand shop course session was devoted to it.

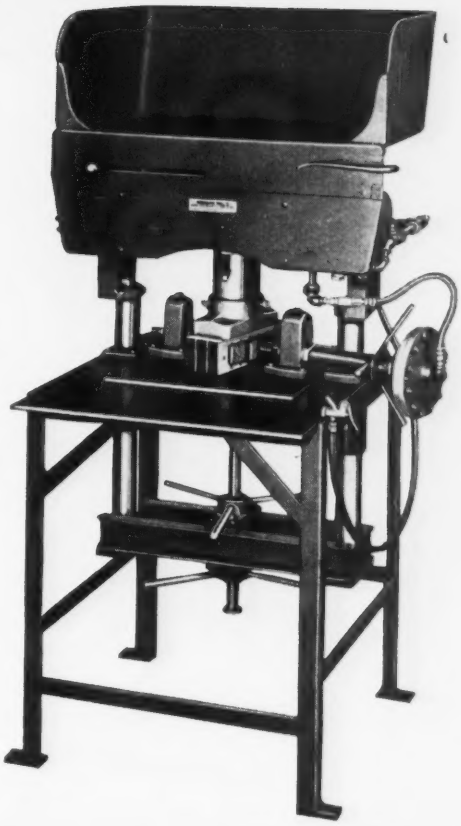
Discussion leader was W. M. Peterson, M. A. Bell Co., St. Louis, who recently experimented with five of the better-known, high-density materials. Presiding was H. W. Meyer, General Steel Castings Corp., Granite City, Ill. The five materials embraced silica, zircon, chrome ore, silicon carbide and alumina. All are utilized by mixing with water and, because of their high density, produce a chilling effect upon metal poured into the molds. They also improve casting finish.

The speaker concluded that zircon

(*Continued on page* 150)

Redford CORE BLOWERS

Assure MAXIMUM Production With MINIMUM Effort



THE NO. 2 STATIONARY MAGAZINE TYPE

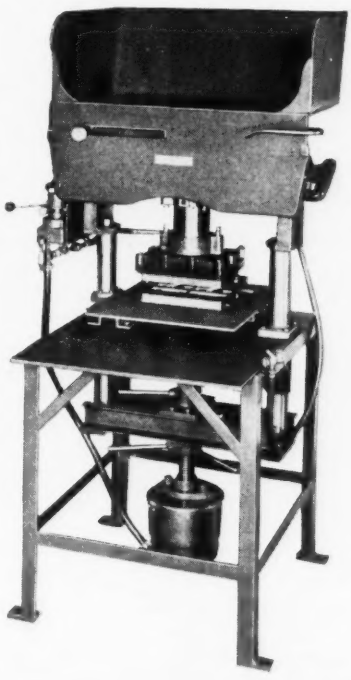
8 OUTSTANDING FEATURES:

1. Large stationary work area.
2. Large sand supply hopper.
3. Stationary sand magazine.
4. Easy accurate locating of core boxes.
5. Quick change magazine heads.
6. Quick adjustment for different height core boxes.
7. Quick change, fully adjustable, vertical clamping attachment.
8. Actuating one handle clamps the core box, blows the core and releases the core box, in two seconds.

CAPACITY: Cores up to 5#

Write for Specification Bulletin "F"

THE No. 2-D CORE BLOWER



A fast and accurate DRAW TYPE core blower for small work—has stationary sand magazine and many additional features assuring maximum production. Quickly adjusted to accommodate core boxes not requiring the draw feature. Can be equipped with clamping attachment for vertically split core boxes.

SIX FEATURES:

1. MAXIMUM SAFETY—Operator must use both hands at once to clamp core box and blow cores.
2. ACCURATE DRAW—Stationary sand magazine and long lead on draw table shaft assure accurate draw.
3. ADJUSTABLE LENGTH OF DRAW—Quickly changed without changing height of table.
4. FLEXIBILITY—Easy adjustments permit use of draw feature even on short run jobs. Draw type magazine heads having removable blow plates are interchangeable with regular No. 2 magazine heads.
5. CORE BOX VIBRATION—Controlled by keeping draw valve handle depressed during draw operation.
6. PROVEN—The No. 2-D is being used in leading foundries everywhere. Backed by the Redford reputation for quality equipment.

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THE CARTRIDGE TYPE BENCH CORE BLOWER

The original small core blower . . Proven simplicity, speed and flexibility. Makes cores up to 2#.

Thousands in use in American Foundries . .

Write for Specification Bulletin "G"

Redford IRON & EQUIPMENT CO.

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(*Continued from page* 148)

offers the most advantages. It is widely used in steel and alloy steel practice, not only for molds, but for cores and washes. It also proves economical with gray iron and brass. As compared with other materials, the cost is relatively high, being about $50 per ton in carload lots.

Discussion following Mr. Peterson's presentation brought out that zircon, as well as some of the other high-density materials, do not produce sufficient chill to cause trouble in machining. It was pointed out also that when zircon is used as a wash, noticeable improvements in cleaning are observed. This apparently results because the wash presents a denser surface against the metal.

The concluding sand shop course had seven speakers, each of whom offered suggestions under the general title "Household Hints & Tips." Conducting the session were Bradley H. Booth, Carpenter Bros. Inc., Milwaukee, and Richard H. Olmstead, Whitehead Bros. Co., New York.

Bake Cores Properly

The influence of proper baking of cores was graphically illustrated by J. A. Rassenfoss, American Steel Foundries, East Chicago, Ind. He emphasized that room temperature tests of tensile properties do not evaluate the high temperature compressive strength of cores. Illustrations of castings made with cores baked for different periods of time, showed that inferior surface finish resulted from those cores baked insufficiently, even though the cores had comparable room temperature tensile strengths. The speaker described a cylindrical test casting used to evaluate core mixtures. This casting is poured so that the metal impinges on the core of the cylinder and the core's resistance to spalling is indicated in the surface of the resultant casting.

How sand pours from a storage bin was demonstrated by R. L. McIlwaine, National Engineering Co., Chicago. By means of a model, the speaker showed that sand drops from the top of a bin directly through the bottom, and that sand along the sides is not disturbed. Consequently, if sand is supplied constantly to a storage bin it leaves practically as fast as it enters it, and little cooling is effected. If it is desired to store sand for a period of time, the answer is to provide several openings in the bin or employ multiple bins.

Use of a four-screen sand was discussed by J. S. Schumacher, Hill & Griffith Co., Cincinnati. This type of sand, having at least 90 per cent on four screens and not over 3 per cent on the next adjoining larger screen size, increases mold hardness, particularly on the vertical surfaces of the mold, and provides better casting surface. It has been employed successfully to replace dry sand molds in certain steel foundries and has effected scrap reduction.

The problem of how to prevent segregation of sand during handling was discussed by Tom W. Curry, Lynchburg Foundry Co., Lynchburg, Va. He pointed out that sand when removed from a silo in the ordinary manner has a different distribution than when the sand is received. This results from the normal type of orifice employed. The Lynchburg company developed a type of orifice which does not disturb the ordinary sand distribution. Mr. Curry recommended a blend of several sands and the giving of attention to sand distribution rather than to fineness numbers.

Tracing the development in sand preparation methods, Chester V. Nass, Beardsley & Piper Division, Pettibone-Mulliken Corp., Chicago, pointed out that equipment now is available for small as well as large foundries. Consequently, the small shop is in a position to reap the benefits from mechanical sand preparation facilities.

Foundries should distinguish between testing and controlling sand, it was pointed out by Tom E. Barlow, Eastern Clay Products Department, International Chemicals & Minerals Co., Jackson, Ohio. While it is desirable to test sand properties, Mr. Barlow pointed out that it is most important to control sand so that given properties are reproduced daily.

The concluding speaker, O. J. Myers, Archer-Daniels-Midland Co., Minneapolis, suggested the use of temperature-indicating pellets on or in cores to check whether or not the cores are being baked at the proper temperature. Another suggestion was the use of about an inch of sand mixed with water and shaken in a bottle to use as a rough comparison between sand composition from one day to the next. To check if cereal has been added to the core sand mixture, a bit of iodine on the mixture will turn purple if cereal is included.

BRASS and BRONZE

A WIDE array of subjects was considered at four sessions held by the Brass and Bronze Division. These included practical problems, gating practice, effect of aluminum on brass and its removal, effect of mold materials, gases and their elimination, grain size, and production of high-pressure castings. Opening gun was fired at a roundtable luncheon Thursday noon at which B. A. Miller, Baldwin-Lima-Hamilton Corp., Philadelphia, and H. L. Smith, Federated Metals Division, American Smelting & Refining Co., Pittsburgh, presided.

One of the points considered was why synthetic molding sands are not used more extensively in molding brass and bronze castings. Discussion indicated that primary reason is lack of equipment for preparation and reconditioning and apparatus for testing and control. However, the consensus appeared to be that synthetic sand use is increasing, and that unless natural sands with more uniform properties could be obtained the trend to synthetic sands would expand.

Another subject of interest was occurrence of hard spots in manganese and aluminum bronze castings. Opinion was that they arise principally from formation of gross iron, zinc-iron or iron-manganese compounds. The latter in finely divided form provide beneficial properties in the bronzes, but when coalesced into larger particles by holding the molten alloys at low temperatures, result in hard spots. Discussion of whether brass and bronze should be melted under oxidizing or reducing atmospheres indicated that both were being employed. However, with reducing atmospheres the melting must be done extremely rapidly.

Second technical session dealt with effect of gating practice on leak tightness of two types of bronzes, and influence of aluminum on gun metal and its removal. Chairmen were G. P. Halliwell, H. Kramer & Co., Chicago, and H. J. Roast, Montreal, Canada. First paper on gating practice was by J. G. Kura, Battelle Memorial Institute, Columbus, O., and L. W. Eastwood, Kaiser Aluminum & Chemical Corp., Spokane, Wash., and was presented by Mr. Kura.

Alloys considered were the 85-5-5-5 and 81-3-7-9 type, and under the particular conditions it was determined that dross and gas holes caused leaks in top-gated castings. Melting methods, pouring temperatures or

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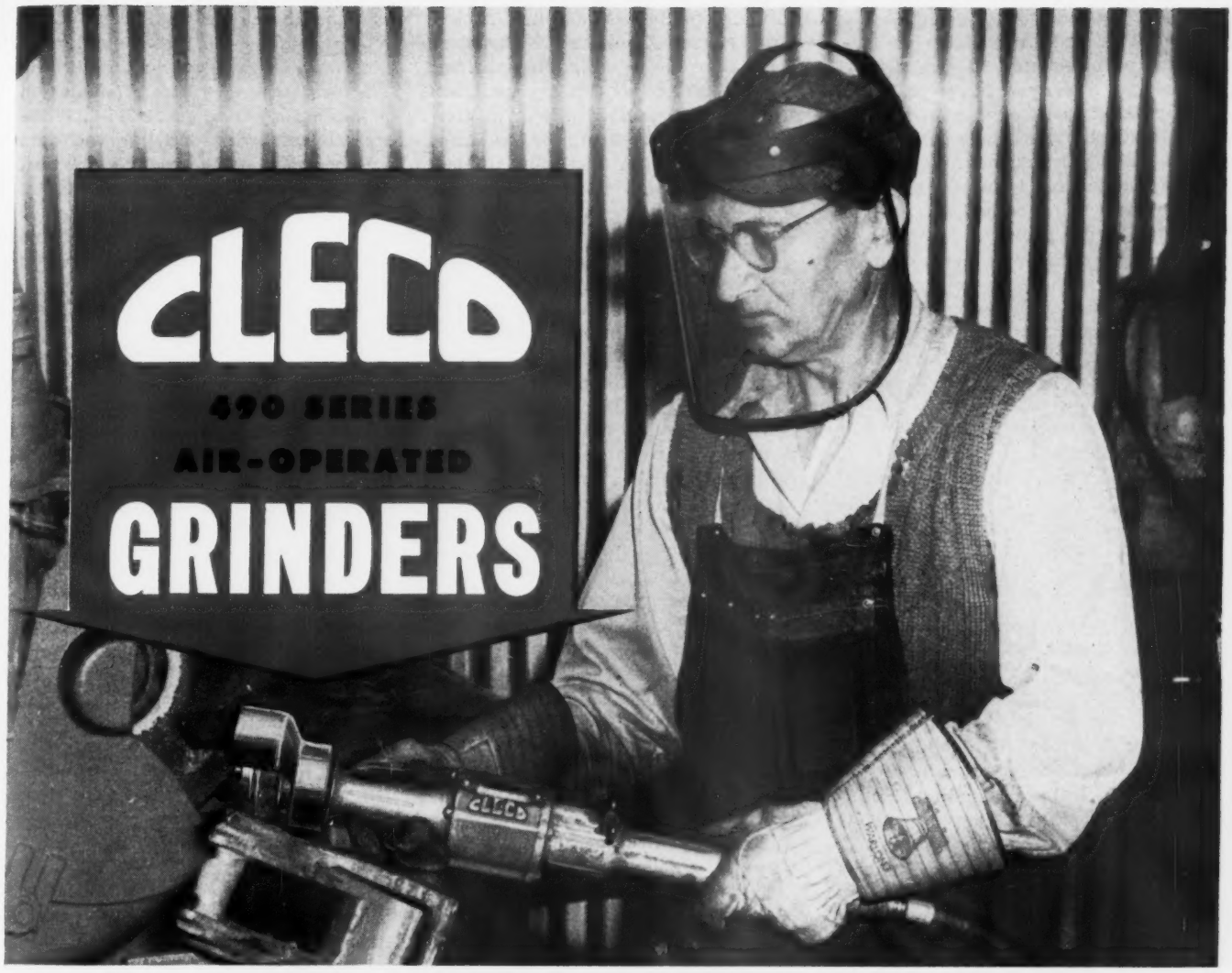

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composition had little effect on frequency of occurrence of this defect. Shrinkage was most likely to occur in top-gated castings without a riser, and least likely to occur in bottom-gated castings. Best pouring temperature as far as lowest percentage of leakers was concerned was around 2075° F for both alloys.

In the discussion it was brought out that presence of a small amount of gas in the alloys was beneficial since it apparently resulted in distributed porosity rather than large voids or interdendritic type of porosity. Also that while bottom gating showed to advantage in the relatively light section castings used in the test, top gating was preferable in heavy section castings to promote directional solidification and eliminate shrinkage voids.

Removal of Aluminum

Second paper, presented by A. V. Larsson, A B Svenska Metallverken, Vasteras, Sweden, was the official Swedish exchange paper, and described the effect of aluminum on pressure tightness of 83-6-5-6 gun metal, and removal of aluminum from that alloy. Data obtained by the author showed that 0.01 per cent Al causes decrease in strength and pressure tightness. Removal of aluminum from the alloy can be accomplished by use of fluoride fluxes such as 30 per cent NaF, 20 per cent CaF_2, 20 per cent Na_3AlF_6, 20 per cent Na_2SO_4 and 10 per cent Na_2CO_3; 70 per cent CaF_2, 20 per cent Na_2SO_4 and 10 per cent Na_2CO_3; and 25 per cent NaF, 15 per cent CaF_2, 15 per cent Na_3AlF_6, 15 per cent Na_2SO_4, 10 per cent Na_2CO_3 and 20 per cent MnO_2.

Discussion indicated that while aluminum is detrimental in high-copper alloys it is not in the high zinc or yellow brasses. One speaker said that for some time he had been using a fluoride flux with the 85-5-5-5 alloy to eliminate cracking in hose couplings which had to be expanded. Up till now he did not know how or why the flux functioned successfully but believed it might be due to removal of small amounts of aluminum.

Two papers provided the program for the second brass and bronze session at which C. A. Robeck, Gibson & Kirk Co., Baltimore, presided jointly with B. F. Shepherd, Ingersoll-Rand Co., Phillipsburg, N. J. Audience numbered 175 to 200.

First paper, "Effects of Mold Materials on Leak Tightness and Mechanical Properties of 85-5-5-5 and 81-3-7-9 Alloy Castings," co-authored by J. G. Kura, Battelle Memorial Institute, Columbus, O., and L. W. Eastwood, Kaiser Aluminum & Chemical Corp., Spokane, Wash., and presented by Mr. Kura, constituted a progress report of a research project at Battelle Memorial Institute for the Brass and Bronze Ingot Institute. Investigation concerned itself with effect of mold material on absorption of gas by the metal.

Fourteen heats were prepared by various methods to produce melt qualities varying from very good to very poor. They were cast into test bars and into leak-test cylinders, four per mold, employing the following mold materials: Calcined clay baked at 1600° F and cooled to 300° F prior to pouring; natural green sand; coated sand; synthetic sand bonded with bentonite and baked at 450° F; and green synthetic sand bonded with bentonite.

Results show that melts prepared under reducing conditions produce fairly sound castings in the calcined clay, whereas the same metal produces extremely unsound castings in the other mold materials. If the melt being poured is low in oxygen and high in hydrogen, absorption of oxygen from water vapor in the molds provides sufficient oxygen for formation and evolution of water vapor. This accentuates microporosity. Apparently, amount of oxygen absorbed from the air is insufficient to produce a damaging amount of water vapor when solidification takes place in a calcined-clay mold.

Study Fracture Test

"Fracture Characteristics and Melt Quality of 85-5-5-5 Red Brass and Other Copper-Base Alloys," second paper at this session, constituted the fourth progress report on a research project sponsored by the research committee of the Brass and Bronze Division. Report was prepared by C. Upthegrove, professor, department of metallurgical engineering, University of Michigan, and F. B. Rote, Albion Malleable Iron Co., Albion, Mich., and was presented by Prof. Upthegrove. Purpose of the project is to develop a fracture test for evaluating melt quality of brass and bronze alloys. Previous progress report presented data on effects of variations in size and shape of the chill block casting and variations in the temperature of the chiller from room temperature to 700° F on fracture appearance of 85-5-5-5 alloy chill blocks.

It was stated that in developing standard fractures, color changes rapidly as a result of air exposure, but no coating is yet available which withstands this color change. The fracture block test is a useful test for quality control but its weak point is that there are no specific tests which indicate the metal quality.

Discussion brought out that the fracture test is more reliable on 85-5-5-5 alloy than on 81-3-7-9. While experiments with one bar will fail, another may result in a perfect test. On the average they will check out. A survey of the audience indicated many are using their own tests and not following the AFS-sponsored tests as they feel the latter too complicated.

Concluding brass and bronze session had W. A. Mader, Oberdorfer Foundries Inc., Syracuse, N. Y., and B. W. Schafer, Kuhlman Electric Co., Bay City, Mich., as chairmen. First paper on "Effect of Lead and Nickel on Grain Size of Certain Cast Copper-base Alloys," by R. A. Colton, F. L. Turk and D. L. LaVelle, American Smelting & Refining Co., Barber, N. J., was presented by Mr. Colton. According to the authors 0.25 per cent or more of lead in pure copper has considerable grain refining influence. In a Cu-Sn alloy with 7-8 per cent Sn, addition of 2-3 per cent Ni contributes to refining of grain size; and presence of 1 per cent Pb in a 5 per cent Sn-5 per cent Ni alloy refines the grain size compared with a lead-free alloy.

Lead Has Effect

During the discussion J. R. Kattus, Southern Research Institute, Birmingham, Ala., inquired as to the deoxidation agent used, and the reply was that none was required under the melting conditions used. Some member pointed out that in the nickel-tin-copper alloy, the presence of 0.005 per cent Pb inhibits age hardening effects and decreases tensile strength and elongation. G. P. Halliwell, H. Kramer & Co., Chicago, asked about the possibility of lead segregation, and it was mentioned there was a possibility although there was no direct evidence. Bernard Ames, Brooklyn Naval Shipyard, New York, stated that experimental work indicated that superheat has no effect on grain size and that cooling effect is most important.

George E. Dalbey, Mare Island Naval Shipyard, Vallejo, Calif., presented a paper prepared in co-operation with Thornton C. Bunch, on use of aluminum bronze for high-pressure castings, instead of the 88-8-4 gun metal alloy. Mr. Colton said he believed the method of gating the gun metal casting was not the most suitable, and the authors stated the reason for gating both alloys the same was to keep similar conditions. S. W. Chappell, Electrical Boat Co., Groton, Conn., stated that he had no diffi-

(*Continued on page* 154)

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(*Continued from page* 152)
culty in obtaining solid castings of the same type in gun metal by top pouring with a chill at the bottom. An English visitor directed attention to the Durville method of pouring aluminum bronze to eliminate turbulence. He also stated that fluoride fluxes should not be used with aluminum bronze since they had detrimental effects.

Final paper on the program was "Melting in a High Speed Reverberatory Furnace" by W. B. Scott and R. G. Carlson, National Bearing Division, American Brake Shoe Co., Meadville, Pa., which was presented by Mr. Scott. He stated that, with the exception of 99 per cent copper heats, an atmosphere containing an excess of 0.5 per cent oxygen gave the best results. With the high copper, such an atmosphere gave excess slag and the metal appeared wild, so it was made slightly reducing. Mr. Scott stressed importance of careful skimming of slag before tapping to prevent build-up of that material in the furnace. Melting time was given as 15 minutes for a 600-lb unit and 35 minutes for a 2000-lb unit. Metal losses are well below 2 per cent overall. Major problem of maintenance is refractory material which is subject to severe operating conditions.

SAFETY and HYGIENE

SAFETY and Hygiene Division of the AFS sponsored three sessions during the International Congress. Ventilation, air pollution and worker safety problems were discussed, and the society's safety and hygiene program was outlined.

A. L. Hunt, National Bearing Division, American Brake Shoe Co., St. Louis, was chairman at the first session and C. K. Faunt, Christensen & Olsen Foundry Co., Chicago, was co-chairman. Introduced at the meeting was W. N. Davis, formerly of the National Safety Council, who has been appointed by the society to head its safety and hygiene program.

An excellent review of methods to ventilate nonferrous melting and pouring operations was presented by H. J. Weber, American Brake Shoe Co., Chicago. Mr. Weber recommended that industry take the initiative in solving the ventilation problem, doing the job as funds permit rather than waiting until intolerable laws are enacted which may force the small operator out of business.

Mr. Weber then explained the dangers to human health where the melting of even small amounts of lead are present. Experience has indicated that concentrations of lead below 1.5 milligrams per 10 cubic meters of air are safe for all persons during a lifetime of exposure. He also pointed out that fumes from melting and pouring are more hazardous than machining jobs. He suggested that the job of control be done gradually, starting with the worst offender. Also, there are minor changes that can be made with little or no cost, such as covering the crucible while it is being moved from the furnace to the pouring station. Mr. Weber then illustrated with slides various hoods and baffles that have been adopted by his organization to divert fumes into ventilating systems. He recommended in nonferrous foundries that general roof ventilation be used only as an adjunct to local exhaust ventilation.

In the discussion, the speaker pointed out that metallurgically pure copper still contains sufficient lead to present a hygienic hazard. In handling zinc, men may suffer from zinc poisoning which is temporarily discomforting. However, the effects of lead are accumulative and are damaging to the body.

Recommendations on "Maintenance of Foundry Ventilation and Dust Collecting Systems" were offered by Kenneth M. Smith, Caterpillar Tractor Co., Peoria, Ill., in the session's concluding paper. He first suggested establishing a preventive maintenance program including a schedule of inspection, availability of complete engineering drawings and competetent people assigned to the job. In setting up equipment, determine if parts can be replaced easily or if the equipment can be cleaned and serviced readily as part of routine maintenance. In this connection, adequate catwalks and ladders for servicing and inspection encourage proper maintenance. A file of complete nameplate data of all equipment with lists of parts furnished by equipment manufacturers and engineering drawings showing any changes made to equipment during installation will assure its being returned to correct working order after repairs and also will minimize time required to complete servicing.

In connection with fans, most trouble can be attributed to dirt, abrasive cutting on housing or impellers and too much heat from the air handled. Where dirt is excessive, trace its source and remove the source if possible. For foundry applications, centrifugal fans with large impeller vanes are more practical than those with small vanes. Where vanes wear down rapidly on propeller fans, he suggested checking into the need of dust collecting equipment.

Ducts in connection with pouring, molding and shakeout operations should be cleaned regularly and where condensation products are present, drainage must be provided. To eliminate the fire hazard in foundry core ovens, he suggested building two ducts, one sealed inside the other with an air space between. Hoods for foundry applications should be rugged. For cleaning space heaters, the speaker suggested a steam generator which forces steam and a cleaning solution through the unit. A trough should be placed beneath to catch the residue.

Mr. Smith concluded his paper with a review of the various types of dry and wet type dust collectors and points to be watched in their maintenance.

Outlines New Program

Second safety, hygiene and air pollution session was under the direction of F. W. Shipley Caterpillar Tractor Co., Peoria, Ill., and J. R. Allan, International Harvester Co., Chicago. Mr. Allan outlined the new ten-year program formulated by AFS to develop engineering standards covering safety, hygiene and air pollution practices.

The speaker reviewed early work of the AFS Safety and Hygiene Committee in preparing codes of recommended practices which have been widely used. Need for more aggressive safety and hygiene work prompted the establishment a little over a year ago of a comprehensive program to incorporate revised codes, research in foundry safety and air pollution, dissemination of useful information, and co-operation with professional societies and governmental agencies concerned with the problem. To finance this ten-year program $350,000 is being sought from industry in voluntary subscriptions.

In the second paper, "The Foundryman Looks at Air Pollution," by N. H. Keyser and H. P. Munger, Battelle Memorial Institute, Columbus, O., Mr. Keyser said each foundry presents an individual case in correcting emission of smoke and fumes. Size of particles determines the distance they will travel. Slides were shown of various types of equipment available for the control and collection

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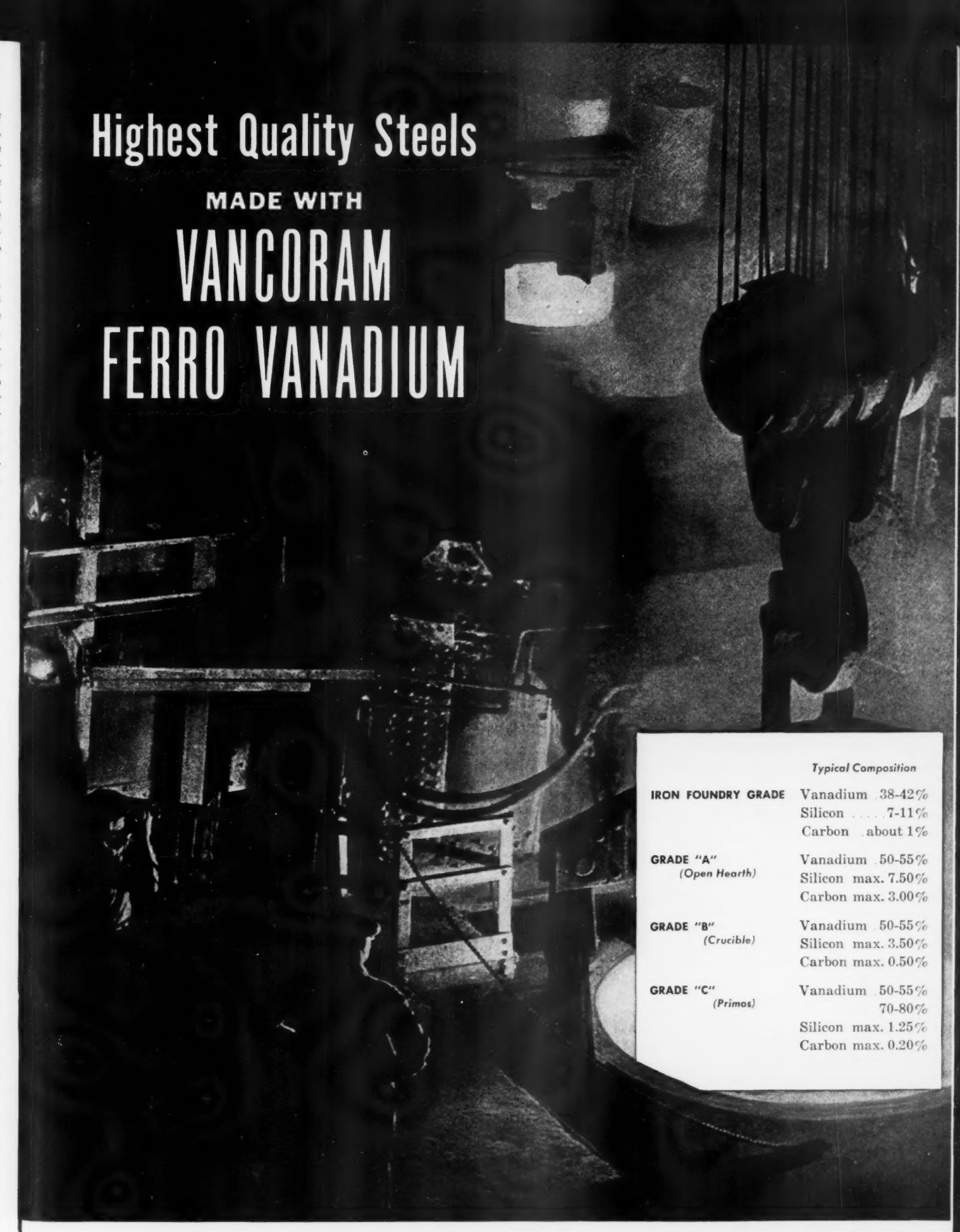

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of dust and fumes.

"Health Problems of the Metal Castings Industry" was discussed by the third speaker, Dr. D. A. Irwin, Aluminum Co. of America, Pittsburgh. He said good health can be achieved by teamwork on the part of the top management, safety directors, engineers and physicians. Among principal hazards in the foundry industry are lack of good housekeeping, exposure to gases, poor lighting, excessive heat and noise. Suggestions for improving working conditions included use of nonsiliceous parting compounds, control of dust and fumes, elimination of sand additives which can induce dermatitis, prevention of metal burns and their careful treatment when they occur.

J. M. Kane, American Air Filter Co., Louisville, presided at the third session. Dan Farrell, United States Steel Co., Pittsburgh, discussed "The Single Objective Approach to Foundry Safety," a program in use at U. S. Steel plants. Since 1948 the company has cut its accident rate 51 per cent, and one plant has operated three years without an accident.

In suggesting occupational improvements, Mr. Farrell mentioned that foreman's accident reports make it possible to analyze accident causes and select remedies. It has been found that certain occupations account for the highest percentage of injuries; in the foundry 6 of 27 types of accidents accounted for 63 per cent of all injuries. In studying 2000 accident cases it was found workers had assumed hazardous positions, erred in judgment, lacked interest and became careless.

In the concluding paper, "Air Pollution and the Cupola," by J. Radcliffe, Ford Motor Co., Dearborn, Mich., the speaker stated that proper draft must blow fumes out of the cupola and that this particulate, along with smoke at time of lighting, comprise the air pollution problem. Methods of measuring dust emissions, and different types of collector systems were described. The latter included typical dry and wet types and electrical precipitators.

PATTERNMAKING

THREE sessions devoted to various aspects of patternmaking were held by the Pattern Division. The first, under the chairmanship of E. T. Kindt, Kindt-Collins Co., Cleveland, and Vaughan C. Reid, City Pattern Foundry & Machine Co., Detroit, included two papers.

Under the title, "Coreboxes from Core Plugs," J. E. Mathias, Accurate Match Plate Co., Chicago, described the method employed in developing aluminum coreboxes and driers from wood or metal master core plugs. Advantages claimed for the process include: (a) A greater degree of accuracy since the same amount of shrinkage can be allowed for both master pattern and master core plug. (b) Master core plugs can be made in less time than a core cavity. (c) The master core plug can be proved in a plaster mold. (d) Eliminates the necessity of making wood master patterns for driers. (e) One master plug usually will suffice for multigang boxes.

Since this method involves the use of plaster molds, dimensional accuracy and smooth surfaces substantially reduce and, in many instances, eliminate machining time. With the aid of a number of slides the speaker presented a detailed description of step by step construction of several typical coreboxes and drier shells. Clay sheets of definite thickness spread over certain areas on the plaster provide the required metal thickness in the resulting casting.

In the second paper at this session, "Patternmaking To Compensate For Shrink Allowance," and presented by M. K. Young, United Gypsum Co., Chicago, use of high-expansion plasters for fabricating expanded patterns, molds and models was described as an outstanding development of the last five years. Industrial tooling and patternmaking materials such as high-expansion and medium-high-expansion gypsum cements have many applications in the aircraft, automotive and foundry industries.

In a general description of the application of the material the speaker emphasized the necessity of extreme accuracy in mixing the cement and water. To illustrate the versatility of the materials in patternmaking for shrink allowance, the speaker presented several typical applications. He claimed utilization of these materials will insure accuracy, expediency and economy where the traditional equipment is being converted for the shell molding process.

Discussion of patternmaking was continued the same day at a roundtable luncheon presided over by Mr. Kindt and A. F. Pfeiffer, Allis-Chalmers Mfg. Co., Milwaukee. Two papers were presented at this session. The first, "Pattern Apprentice Training Program," was by F. W. Burgdorfer, Missouri Pattern Works, St. Louis.

Although management, in Mr. Burgdorfer's opinion, has recognized the importance of acquiring and training a competent supervisory force, it has overlooked an important item—apprentice training. Management is to be commended for its fine work among university and college groups in bringing the industry before them, but unless it includes apprentice training it is only doing a halfway job. Skilled tradesmen always must outnumber technical experts.

Suggests Joint Committees

The only sound answer to the apprentice problem is to formulate joint management-labor committees to study industry needs and then draft a program to suit these needs. For many years individual employers tried without success to get additional metal patternmaker's apprentices. When the joint committee tackled the problem the shops had all the apprentices they could handle. The remainder of the paper discussed methods employed by the St. Louis Pattern Manufacturer's Association in developing and applying an apprentice training program. In concluding, the speaker pointed out that no standard program will suit every community, but that one similar to that in St. Louis could be used as a basis from which a sound program could be built to suit any area.

In the second paper, "New Methods in Metal Patternmaking," by H. J. Jacobson, Industrial Pattern Works, Chicago, the speaker referred to the fact that although metal in one shape or another had been worked for thousands of years, men became proficient in only comparatively recent years.

Patterns at one time conforming to the gradations on a foot rule now must conform to micrometer reading. Production castings finished in automatic machines must be extremely accurate in size and shape. Approximately 40 years ago a method for electric deposition of copper on a master pattern provided any desired number of accurate duplicate patterns. In more recent years a method for pressure casting aluminum pattern plates was developed. The valve and fitting shops were the first to adopt these developments. With the aid of several slides the speaker showed several typical pattern layouts and explained the distinctive features in considerable detail.

(*Continued on page* 158)

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(*Continued from page* 156)

V. J. Sedlon, Master Pattern Co., Cleveland, and co-chairman H. C. Swanson, Arrow Pattern & Foundry Co., Chicago, presided over the final pattern session. The first paper, "Practical Construction of Wood Patterns," was presented by Walter Siebert, Elyria Foundry Division, Industrial Brownhoist Co., Elyria, O.

The author pointed out that to produce a satisfactory pattern young men must be taught there is more to modern patternmaking than haphazard guessing. The patternmaker must be able to visualize everything that goes into the making of a large piece of equipment. To do this he must have a working knowledge of a designer, a machinist and, above all, of a molder and coremaker. With the aid of several slides the speaker went into intimate detail on the construction of a pattern for a typical machine tool casting. He strongly advised consultation with the foundryman as an aid in determining molding methods, flask size, core supports, core vents, gates and risers, best surface to have in the drag, and arrangement of cores to eliminate use of chaplets where a leak-proof casting is required.

In selecting lumber, he said, do not skimp on thickness. Where a sandslinger is employed to make the mold, light lagging will yield sufficiently to prevent drawing the pattern. Heads should be sturdy with a maximum of 16 in. between them. After all the heads are erected on a perfectly flat surface the rails are screwed to the outside. A somewhat common practice of recessing the rails into the heads weakens the structure. The outer lagging is attached to the rails with the grain of the wood following the draw of the pattern.

Other features discussed included size and location of draw straps, attachment of loose pieces, use of ramup cores, size and shape of core prints and pattern draft. Usually $\frac{3}{16}$-in. draft for every 2 ft of pattern surface is sufficient. However, good practice favors all the draft the design will permit. This is particularly applicable to recesses on the cope side. Large coreboxes should be substantially constructed. Finally, patterns and coreboxes should be properly marked for identification. The best method is to use embossed zinc tape.

The second paper, "Patterns for High Production in Malleable and Steel Foundries," by Joseph M. Kreiner, described the design, construction and complete standardization of pattern and corebox equipment for modern high production foundry use. The patterns described are constructed on interchangeable basis, since at least four foundries are supplied with identical patterns. Castings made from the patterns must interchange in an assembly with castings made in eight different foundries.

REFRACTORIES

REFRACTORIES Committee of the AFS co-operated with the Gray Iron and Malleable Divisions of the society in arranging sessions of particular interest to those branches of the industry, in addition to a third session under its sponsorship which considered refractory practice in general.

First of the three sessions dealt with refractories use in the malleable iron industry. W. G. Ferrell, Auto Specialties Mfg. Co., St. Joseph, Mich., was chairman and Eric Welander, John Deere Malleable Works, East Moline, Ill., was co-chairman. C. W. Meyer, Saginaw Malleable Iron Plant, of Central Foundry Division, General Motors Corp., Saginaw, Mich., described that company's practices in a paper, "Refractory Practice as Applied to Malleable Duplexing." Mr. Meyer stated that experiments indicated, after mechanical cupola charging had been introduced, that a soft sand block which withstands the abrasion of the materials is best for that section.

In the melting zone a monolithic lining was adopted. It is 7 in. thick 4 in. above the tuyeres, tapering upward and inward to the double course of bricks to a thickness of 12 in. Advantages of this method have been: Cheaper cost per ton of iron melted due to smaller quantities of refractory material used, and reuse of that portion of the lining not burned out; elimination of major troubles caused by lining failure; and increased size of melting zone at no extra cost.

Monolithic refractories also have been applied to the forehearth and to the transfer ladle. Mr. Meyer then described the method of relining and installing a new bottom in the foundry's three-phase, direct-arc electric furnace. In subsequent discussion, Mr. Meyer stated that the stone used to build the bottom of the furnace was ganister $\frac{1}{8}$ to $\frac{1}{4}$ in. in size, added dry and burned in. Replying to a question by Prof. Richard Heine, University of Wisconsin, the speaker stated that in renewing the refractory in the melting zone of the cupola the depth of the refractory at the tuyere is measured to determine the amount of new refractory necessary.

William C. Corbeau, National Malleable & Steel Castings Co., Cleveland, was the second speaker, his paper being entitled "Air Furnace Refractory Practice in Cupola-Air Furnace Duplexing." Mr. Corbeau stated their melting department comprises two cupolas and two air furnaces, the cupolas being operated on alternate days and the air furnaces alternated in three consecutive working day cycles. The air furnaces were built in 1930 with solid bottoms. Bottom repair is made in three sections with 12 days' production run over each section before it is replaced. In each repair period tap blocks and the section of wall over the tap blocks are replaced. Should the bottom float to the surface while metal is being processed, metal may be drained, into a trough.

Prevent Bottom From Rising

In lining the furnace, the bottom is carried under the side wall and wedged to the jacket course. With a tight job of brick work in the arch and the ends wedged to the jacket course as well as the weight of the side wall holding it down, there is little chance of the bottom rising. Also, superduty brick for the bottom has been found satisfactory. Since construction of the furnaces, practice has indicated the advisability of eliminating the wind bung and modifying the camel-type roof to a straight-line, which is more economical both in increased bung life and in labor to set the bungs.

Concluding paper, "Refractories Applied to Batch Type Air Furnace," was prepared by C. O. Schopp and P. F. Ulmer, Link-Belt Co., Indianapolis, and presented by Mr. Schopp. Practices developed in this plant are a compromise between maximum efficiency and the cost of refractories. Major repairs are necessary after ten heats and the decision to make whatever replacement or repairs necessary rests with the repair foreman. Bung supports are cast iron frames with malleable iron shoes which take up slack to hold roof refractories in place. Bungs are switched in location depending on service life since those nearer the burner wall face suffer more severe conditions than those at the opposite end of the furnace. The furnace bottom is sand, and scrap boards cover this before the first charge.

Second refractories session had R. H. Stone, Vesuvius Crucible Co.

(*Continued on page* 160)

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SHOT—GRIT—BLAST SANDS
REFRACTORIES • BENTONITE
RE-BONDING CLAYS

(*Continued from page* 158)

Pittsburgh, and W. R. Jaeschke, the Whiting Corp., Harvey, Ill., as chairmen. J. D. Custer and J. Spotts McDowell, Harbison-Walker Refractries Co., Pittsburgh, in their paper, "Fundamentals of Foundry Refractories," which was reviewed by Mr. Custer before approximately 100 listeners, discussed developments in metallurgy, and foundry practice which have been influenced by progress in refractories manufacture.

It was pointed out that basic cupola operation involves considerable experimentation with refractories, and the speaker also traced progress in adapting super-duty and high-alumina refractories to use in malleable foundries and in electric steel-melting furnaces where high temperatures are employed. Intermediate and low-duty fireclay brick are applicable in certain portions of many industrial furnaces where structure is subjected to relatively moderate or low temperatures. High-duty class of fireclay brick are recommended in upper section of cupola linings. In the melting zone, high-duty fireclay brick of the extruded type are adequate. Abrasion may be a factor but usually resistance to corrosion and erosion by the slag and metal is of greater importance. Super-duty fireclay refractories are available in the conventional burn and extra hard burn varieties. Important properties are their high refractoriness, low porosity and excellent volume stability in the high temperature range.

High-alumina refractories have excellent resistance to spalling effect of rapid temperature changes. Ganister-fireclay mixes have been improved recently and are used for maintaining melting zone linings of cupolas.

Hydraulic setting castables of the 3000° type have given excellent results when used for patching rim and lips of iron ladles. Plastic fire brick from calcined and bond clays are used for gray iron ladle linings, cupola troughs, and other applications. With graphite added, plastic fire brick is very refractory and is used for gray iron ladle linings, tap-out blocks and cupola spouts. It is not recommended for use in steel ladle linings where low carbon steel is produced.

Second paper, "Effect of Slag on Furnace Linings," by L. B. Wyckoff, Electro Metallurgical , Co., retired, Lewiston, N. Y., dealt with chemical reactions of the slag. Saturation of slag with respect to lining material and maximum furnace temperature was given as the basis of preventing lining erosion.

Conclusions drawn were that effect of slag erosion on furnace linings is due to chemical action leading to solution of refractory elements in slag. Slag forming elements combine to form low melting compositions called eutectics and high melting compositions. For a given temperature there is a line of limiting compositions in a ternary diagram on one side of which all particles may be put in solution and on the other side of which excess of one or more of the elements will remain solid. This would be the isotherm of the liquidus temperature. When lining material, if dissolved, would raise melting point of slag above maximum furnace temperature, corrosion of lining would be reduced to a minimum. Slags are never completely uniform and some portions of slag may be of such composition as to dissolve part of lining even though average or bulk of slab would be neutral.

At the concluding refractories session, of which the Gray Iron Division was a co-sponsor, R. A. Witschey, A. P. Green Fire Brick Co., Chicago, presided, with S. F. Carter, American Cast Iron Pipe Co., Birmingham, as co-chairman.

M. W. Demler, Harbison-Walker Refractories Co., Pittsburgh, presented the first paper, "Basic Refractories for Cupola Service." Mr. Demler discussed the general application of acid and basic slags and the effect of each on refractories. He then described properties of basic refractory materials, including chemical compositions, spalling resistance and high-temperature strength. He particularly stressed the reversible thermal expansion of several refractory materials and their high heat conductivity.

Provide for Expansion

When lining a cupola, therefore, allowance must be made for the expansion, and he suggested placing cardboard strips between bricks and courses because they permit expansion room when they burn out. Regarding heat conductivity he suggested that a course of high-duty fireclay brick be placed between the inner basic lining and the shell.

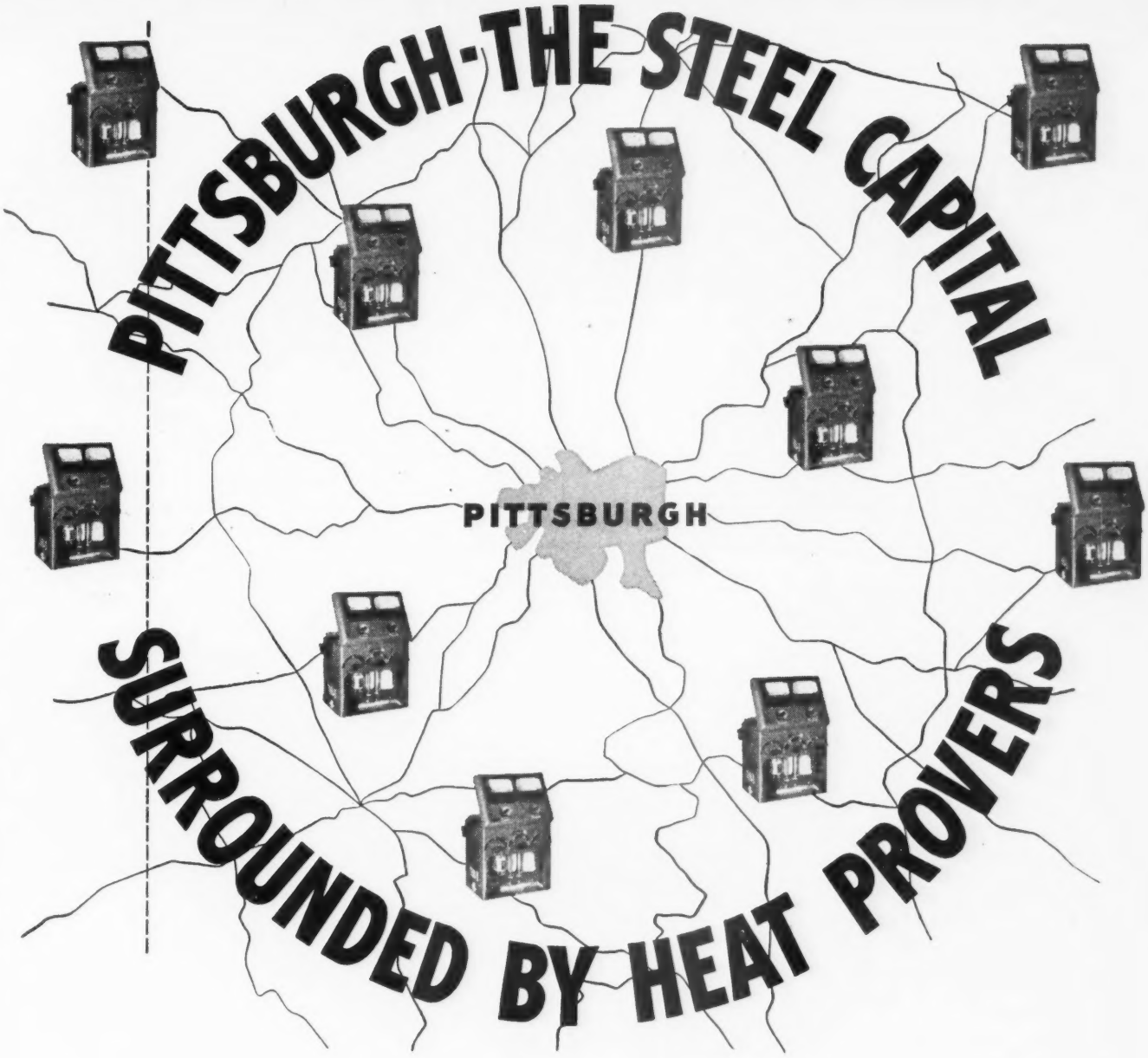
Properly maintained, a basic lining lasts longer than refractories in acid operation. But its initial cost is much higher.

Concluding paper, "Refractories for the Basic Cupola," was by H. M. Kraner, Bethlehem Steel Co., Bethlehem, Pa. He stated that the idea that all one has to do to provide resistance to a basic slag is to use a basic refractory is erroneous. The problem of refractory life involves a compromise between viscous slags which neither dissolve the refractory nor carry out the desulphurizing process and slags of proper composition and viscosity which do a good job of desulphurizing but also dissolve considerable refractory. Increasing slag temperature increases its dissolving action. Carbon as a refractory is a possible exception because it holds up well in the presence of slags corrosive to most other refractories, but water cooling is necessary with its use.

The speaker pointed out that one basic cupola operator had used carbon backed up with magnesite brick in a water-cooled shell. Results were good. It was the speaker's opinion, however, that the carbon should be near the shell to help cool the inner

(*Continued on page* 162)

SHELL MOLDING PANEL: Participants in the symposium on shell molding at the AFS congress included: Seated—Vaughan C. Reid, R. H. Jacoby, Bernard N. Ames, R. W. Crannell. Standing—N. A. Kahn, H. K. Salzberg, G. M. Etherington, E. N. Harrison. The symposium attracted a large audience



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(*Continued from page* 160)

wall or that the magnesite brick should be eliminated. In any event the major increase in refractory life is probably due to water cooling. With water cooling it even might be practicable to use high grade clay refractories in cupolas.

A written discussion by W. W. Levi, Lynchburg Foundry Co., Radford, Va., pointed out that slags of a given basicity and relatively poor fluidity may be less effective in removing sulphur than a less basic, highly fluid slag. He pointed out that cupola slags have more severe action on refractories than open hearth slags and also that basic refractories are attacked by basic slags. Operations at his foundry have been successful with a rammed carbon lining backed with magnesite brick. In carbon linings, however, a baked carbon brick ought to be used, but it is not available for cupolas.

Mr. Carter, in a written discussion, stated that he has tested carbon and graphite linings laid close to the shell, with no insulation, in a water-cooled cupola and obtained good results.

General discussion brought out the points that basic slags have been produced in acid-lined, water-cooled cupolas and that the desulphurizing power of a basic slag is in inverse proportion to increased basicity and decreased viscosity.

ALUMINUM and MAGNESIUM

ALUMINUM and magnesium meetings included four technical sessions and a roundtable luncheon. Eight papers and one motion picture were included in the program.

Anthony Cristello, American Light Alloys Inc., Little Falls, N. J., presided at the first session with H. E. Elliott, Dow Chemical Co., Bay City, Mich. as co-chairman. Donald A. La Velle, American Smelting & Refining Co., Barber, N. J., presented a paper on "Aluminum Sand Casting Defects —Their Identification, Causes and Corrections."

Mr. La Velle pointed out that any defect can result from many causes and that a number of remedies may be used to eliminate that defect. In many cases defects may appear to be similar when they result from different causes. When corrective methods have been taken and the defect persists, it may be concluded that the defect was incorrectly identified and improper correction measures used.

The speaker showed slides of a number of defects and suggested corrective measures.

Discussion brought forth the comment that small percentages of boric acid found on aluminum casting surfaces result from the use of magnesium system sand in molds for 356 aluminum alloy castings. As little as ½ of 1 per cent of such sand in the total aluminum system will cause small, bright spots on aluminum casting surfaces.

A contrary opinion, however, stated that boric acid was added to aluminum system sand to eliminate pinholes on the drag side of large castings with heavy sections. Alloy used was 355.

In his paper on "Heat Treatment of Magnesium Alloy Castings," E. M. Gingerich, Aluminum Co. of America, Cleveland, pointed out that principles of heat treatment for magnesium alloys are similar to those of other nonferrous alloys, involving four common commercial practices: Solution heat treatment, artificial aging, solution followed by artificial aging, and solution followed by stabilizing treatment. The various treatments affect tensile and yield strengths, elongation or ductility, hardness and impact resistance; they also relieve casting or quenching stresses, and develop dimensional stability.

The speaker discussed equipment, procedures and results of the different treatments with respect to common magnesium alloys. Some of the hazards involved, their avoidance or control, also were covered.

Particular emphasis was placed on the phenomenon of germination—the tendency of some magnesium alloys to develop large grains when held at temperatures at or near the heat treating temperature. Germination seriously affects mechanical properties of castings. He listed conditions existing during heat treatment which cause germination. A method of preventing the phenomenon is an interrupted solution heat treatment which involves breaking up the heat treating temperature into several periods with intervening cooling periods.

In a written discussion, Dr. T. A. Fisher, Magnesium-Electron Ltd., Manchester, England, stated that the problem of germination is over-emphasized. No trouble is encountered with it in England. He has obtained satisfactory results with a simple treatment of heating the alloy in one stage to 780°F for 16 hr. He also stated that many alloys discussed in the paper are not as undeveloped as was suggested, citing the use of over 1000 magnesium alloy castings in England's "Comet" jet passenger airplane as well as in other applications.

The paper, "Alloying Zirconium to Magnesium," by W. P. Saunders and F. P. Strieter, Dow Chemical Co., Midland, Mich., was presented by Mr. Saunders. The paper described the use of various agents for alloying zirconium to magnesium and presented conclusions showing that each agent has some use but that zirconium chlorides and certain master alloys are most suitable from a practical and economic standpoint. Successful production of these alloys requires only careful and straight-forward techniques. Production of over 500,000 lb of the alloys with chloride alloying agents by the authors' company has shown no flux problem.

Procedures discussed in the paper involved the use of metallic forms of zirconium, zirconium chloride combinations, zirconium fluoride mixtures, and master zirconium alloys as alloying additives.

Alloying Technique Slow

Conclusions are that zirconium sponge, a metallic form, produces consistently high soluble zirconium contents, although the alloying technique is slow and laborious. Zirconium chloride base materials alloy readily and nearly as efficiently as the sponge. Zirconium fluoride base materials are less efficient and require a higher alloying temperature. Furthermore, its use requires more labor in the alloying technique because of the more viscous nature of the resulting sludge.

J. W. Meier, Canadian Bureau of Mines, Ottawa, Canada, in a written discussion stated that in his alloying experiments he had obtained most consistent results with zirconium fluoride compounds. He also stated that hydrogen must be removed from the melt because it affects zirconium alloying.

Dr. E. F. Emley, Manchester, England, in a written discussion pointed out that the paper dealt only with the proportions of zirconium introduced into magnesium by the alloying methods and made no mention of properties of the various alloys. Furthermore, the affect of chloride contamination apparently was overlooked. In England the use of master alloys has not been as successful as salt mixtures in obtaining desired tensile strengths. In addition, to obtain alloys free of flux inclusions, a barium chloride flux is used.

At the second session Hiram Brown, Solar Aircraft Co., Des Moines, Iowa, presided, with W. E.

(*Continued on page* 164)

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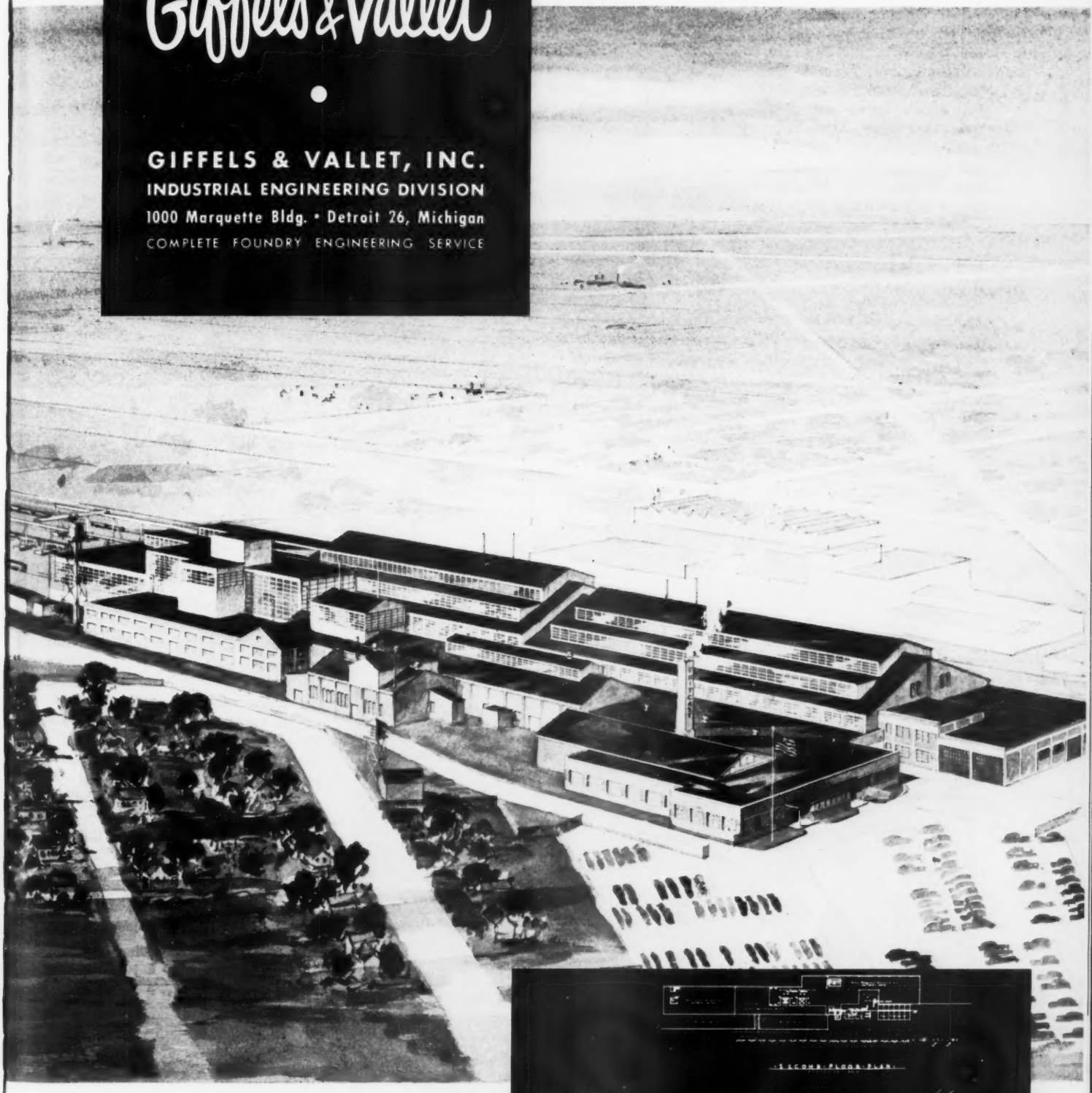
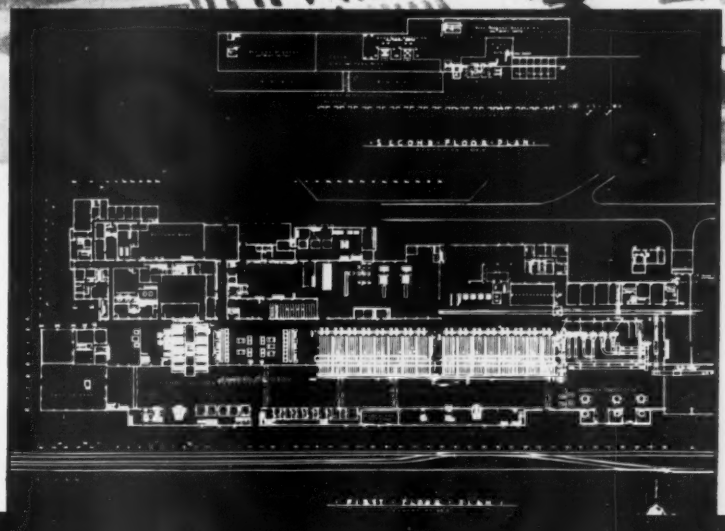




UNITCAST CORPORATION,
Toledo, Ohio

(*Continued from page* 162)

Sicha, Aluminum Co. of America, Cleveland, as cochairman. The paper, "Investment Casting of Aluminum," by H. Rosenthal and S. Lipson, Pitman-Dunn Laboratories, Frankford Arsenal, Philadelphia, was presented by Mr. Lipson.

The work described covered investigation of mechanical properties of aluminum test bars produced by investment casting. Properties of the two alloys tested were found to approximate those obtained by sand casting. A 5 per cent silicon alloy showed 20,000 psi tensile strength and 9 per cent elongation (1-in. gage) when cast at 1175° F to 15,500 psi and 5 per cent for 1615° F. Use of chills and modification of the melt with sodium just before pouring improved these properties.

An alloy containing 4 per cent copper in addition to 5 per cent silicon developed 23,000 psi tensile strength and 3.8 per cent elongation when poured at 1210° F. This alloy, however, was found to be relatively insensitive to pouring temperature.

Since mold temperatures of 250 to 350° F are required when pouring aluminum investment castings, the authors developed a method for melting wax out of the molds in an atmosphere of saturated steam under pressure at 250° F with a final burnout at 600° F for 24 hr or 800° F for 2 hr instead of 1200 to 1350° F as is the usual practice.

In a written discussion Mr. Brown stated that his work has shown aluminum alloys generally are sensitive to pouring temperatures. He also pointed out that test bars discussed in the paper showed no great differences in tensile strengths and elongation although differences in microstructure and grain size were noted. This substantiates some of his work which showed that physical properties and structures are not always correlative.

General discussion brought forth comments that aluminum alloy 356 poured in room temperature molds produced castings with better properties than when molds were heated. It also was pointed out that one foundry heated molds initially to 800° F in an air oven then reduced the temperature to 400-500° F. The residue of wax in the molds had no effect on surface finish of the casting; it only reduced mold permeability.

Another commentor said that wax residue in the mold does affect casting appearance. It also was pointed out that decrease in mold density increases casting porosity and decreases casting tensile strength.

In answer to a question regarding use of the oxidizing agent, potassium chloride, in investment slurry to help burn out wax, it was pointed out that its addition makes control of investment setting time difficult.

Second paper at this session, "Some Practical Applications of Permeable Metal Casting Plaster," was prepared and presented by R. F. Dalton, United States Gypsum Co., Chicago.

The speaker stated that permeable casting plaster is produced by achieving interconnected air bubbles in the mix. These air cells give the mold high permeability, and molds of the material can be headed and gated much the same as sand molds. The material requires a low percentage of water for mixing, thus drying times may be reduced and molds do not have to be calcined, avoiding shrinkage problems.

Mixing, however, must be done with a mechanical unit designed to entrain air into the slurry.

During general discussion it was pointed out that magnesium was poured successfully during experimental work with this plaster when 2 per cent sulphur was added to the slurry and the molds dried at approximately 450° F.

Must Change Practice

Morris Bean, Morris Bean & Co., Yellow Springs, O., pointed out that one of the most important characteristics of a mold is high heat conductivity. Gypsum-bonded molds cannot approach sand molds in this respect. Therefore, foundrymen must be careful in trying to use the same foundry practices in investment molds as are used in sand molds.

The third session featured three papers. The first, "Mechanical Properties of Sand Cast Magnesium-Zinc-Zirconium Alloys," by J. F. Hildebrand and F. P. Strieter, Dow Chemical Co., Midland, Mich., was presented by Mr. Hildebrand. W. J. Klayer, Aluminum Industries Inc., Cincinnati, presided, with Robert C. Boehm, Wellman Bronze & Aluminum Co., Cleveland, as cochairman.

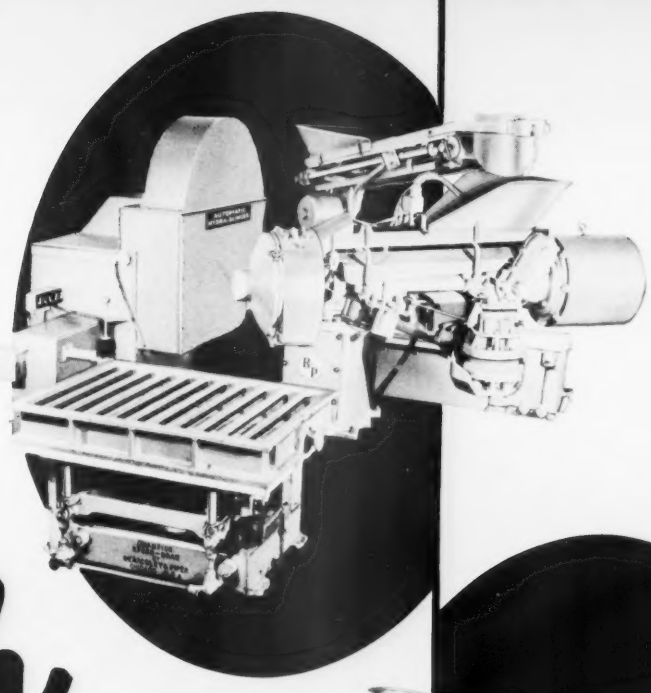
The paper covered tests of mechanical properties of magnesium—5 per cent zinc—0.7 per cent zirconium alloy sand castings. The proposed ASTM designation of the alloy is ZK51A. It is similar to the British alloy Z5Z. Results showed that when aged at 350° F for 12 hr the alloy had a good combination of static and dynamic mechanical properties, being similar to those in present commercial alloys AZ91C, AZ92A, and AZ63A. In addition, it has better ductility at a high level of yield strength.

Further tests showed that equivalent tensile properties cannot be obtained with a simple aging treatment if soluble zirconium content is less than 0.7 per cent. Such alloys had to be solution heat treated at 930° F for 10-12 hr followed by aging to obtain nearly equivalent properties.

Also it was shown that AK51A alloy in the as-cast condition requires a prohibitively long time for stress relief at 350° F. However, 95 per cent stress relief can be obtained by

(*Continued on page* 169)

Among the guests at the International Banquet at Atlantic City were Vincent Delport (left), European representative of the AFS and European manager of *Foundry*, shown with Charles E. Hoyt, retired executive vice president, AFS



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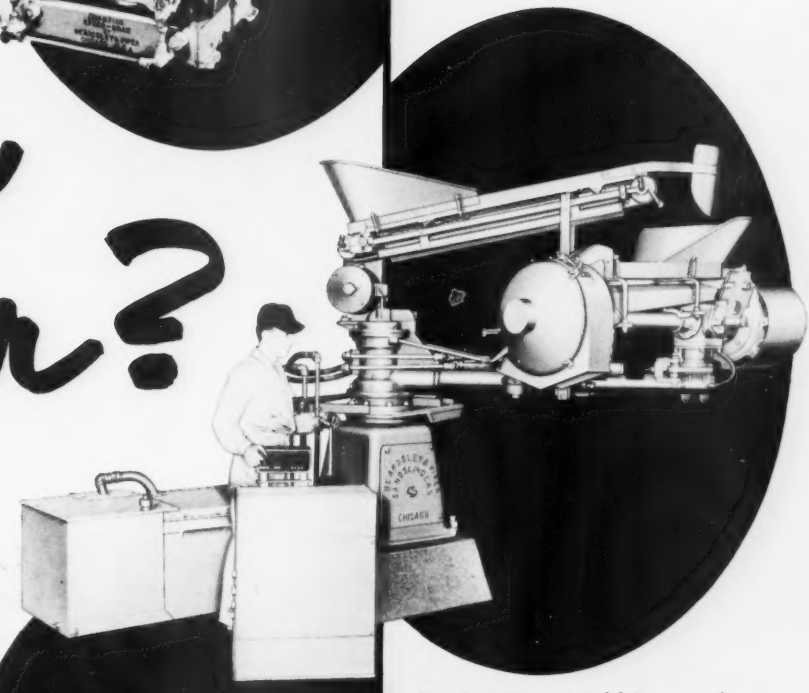

PRODUCTION WORK?
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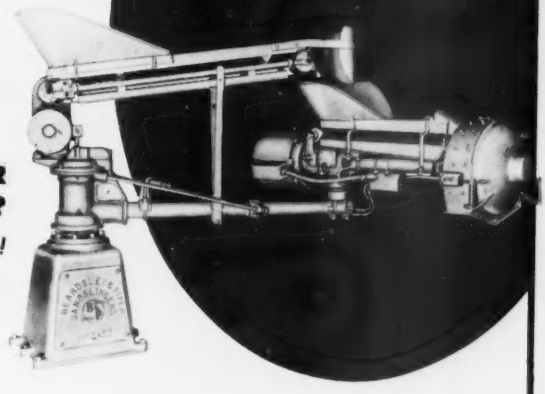

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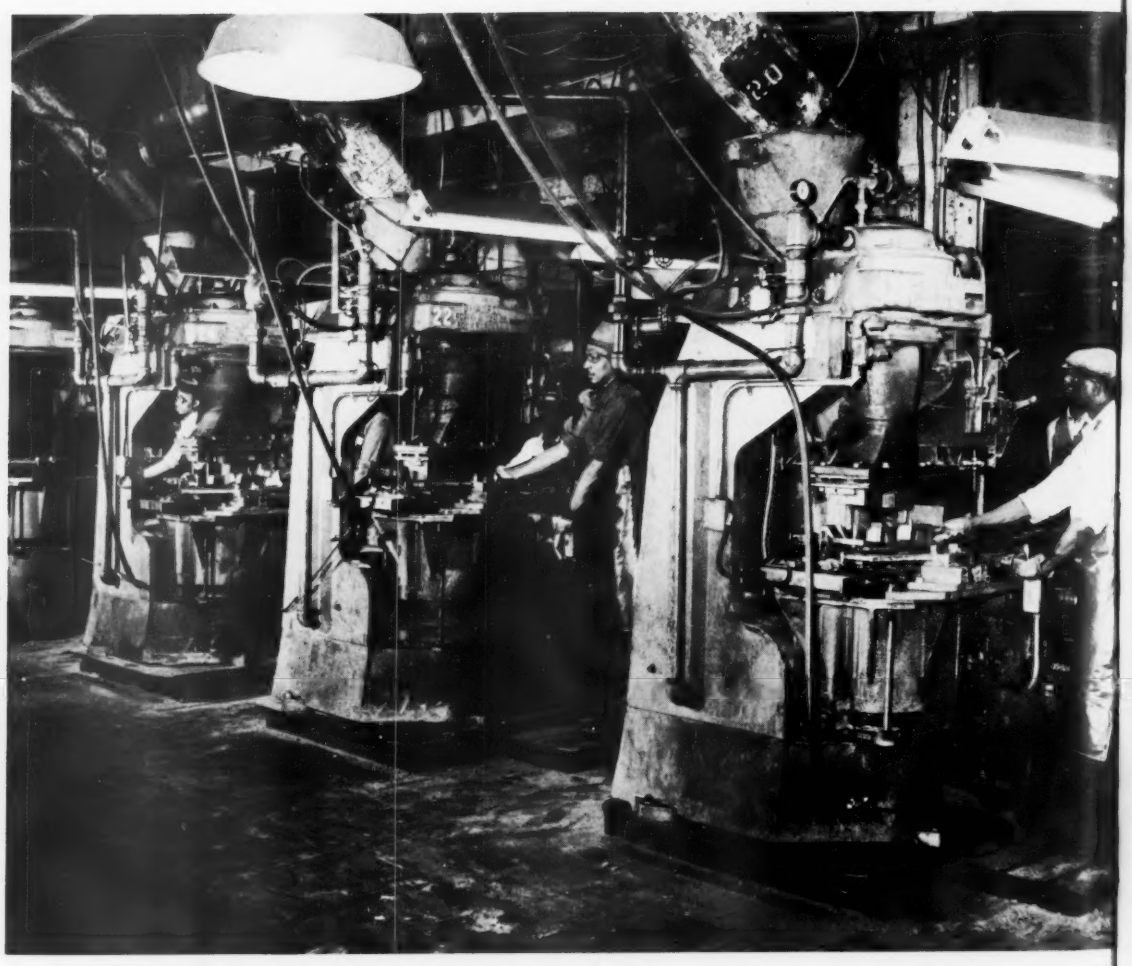

Four of a battery of seven Champion **Blo-Matic** CB-15 Core Blowers making intake manifold cores at the Rouge plant. With Champions production per machine has been greatly increased on these manifold cores.

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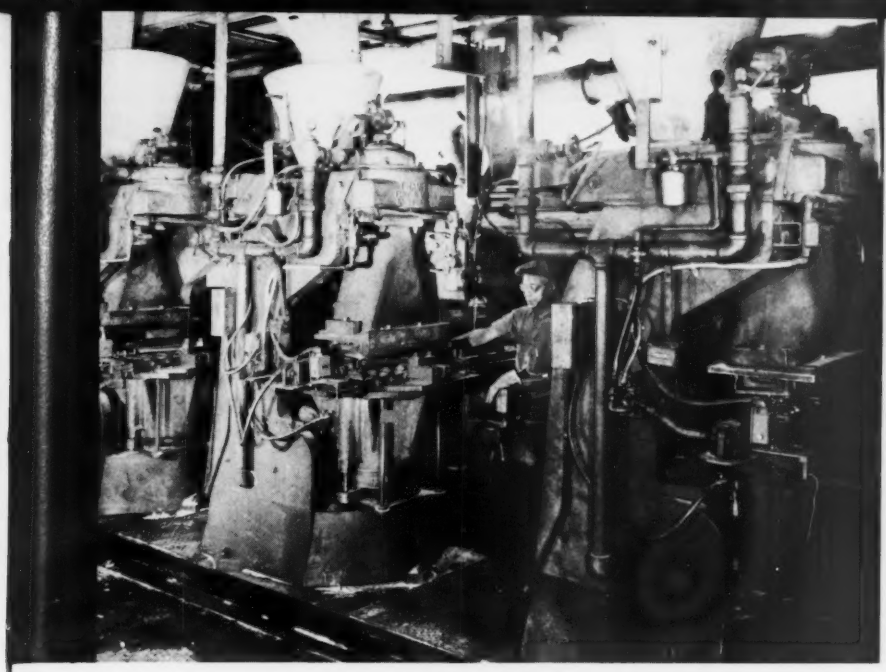

Three of a battery of six Champion **Blo-Matic** CB-15 Core Blowers making cylinder head cores at Ford Motor Company. The efficiency of these Champions is far higher than that of the core blowing machines formerly used on this job.

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1. *Jolt cylinder is internally ported—the exhaust blows the jolt anvil clean on every stroke.*
2. *A knee-valve controls the jolt and a single hand-valve controls squeeze and draw on the 513-6. Two convenient pilot valves control all operations of the 716-8, including the air-actuated swinghead.*
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4. *The 513-6 (illustrated) provides a full six-inch draw, while the 716-8 provides a full eight-inch draw.*
5. *Jolt guide pins work in hardened and ground steel bushings.*
6. *Positive, controlled slow and fast draw on the same stroke, with automatic vibrator control.*
   The length of slow draw on the 716-8 is automatically controlled.

	513-6	716-8
Table size	19″ x 26″	24″ x 34″
Jolt cylinder diameter	5″	7″
Squeeze cylinder diameter	13″	16″
Pattern draw	6″	8″
Jolt capacity	650 lbs.	1500 lbs.

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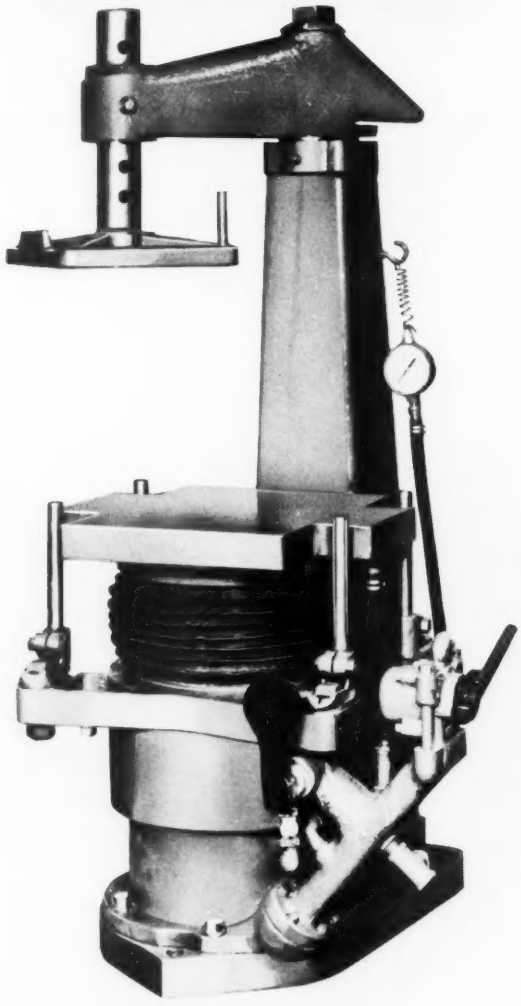

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(*Continued from page* 164)

heat treatment at 600° F for 2 hr.

Castings of this alloy in which fatigue life is critical will require actual service tests before fatigue characteristics of the alloy can be established. High cost of the alloy and surface imperfection of the castings do not warrant commercial use at present, according to the authors.

A written discussion by Dr. T. A. Fisher, Magnesium-Electron Ltd., Manchester, England, pointed out that the authors are misled in concluding that the alloy cannot be used commercially, citing the use of over 1000 magnesium alloy castings, some of the composition discussed, in the British Comet jet passenger airplane. However, the authors do confirm British findings regarding property advantages of the alloy.

The paper, "High Strength Non-heat-treated Aluminum Casting Alloys," by Walter Bonsack, Christiansen Corp., Chicago, was presented by Charles Maxwell, Alumicast Division, Christiansen Corp.

Alloys Heat Treated

The paper compares properties of older type aluminum alloys with those of the newer aluminum-magnesium-zinc alloys. The modern alloys do not require heat treatment for high strength, but if some of them are heat treated, their properties surpass those of older alloys by a wide margin.

As-cast, these alloys show 28,000 to 35,000 psi tensile strength and elongation of 6 to 12 per cent depending upon the alloy. When heat treated, they show 70,000 psi tensile strength, yield of 60,000 psi, and 1 to 2 per cent elongation. When cast in permanent molds they develop strengths of 33,000 to 43,000 psi and elongation of 12 to 23 per cent. Sand castings, when aged three months at room temperature, have 36,000 to 41,000 psi tensile strength and 2 to 8 per cent elongation. The same aging of permanent mold castings promotes strengths of 45,000 to 50,000 psi and elongation of 6 to 16 per cent.

Additional properties of the Al-Mg-Zn alloys are high corrosion resistantance, good brazing characteristics, good dimensional stability and machinability. However, they are not suitable for high-temperature applications and are not as easily cast as Al-Si alloys. In fact, their high properties are destroyed by the addition of silicon.

William Brammer, Apex Smelting Co., Cleveland, in a written discussion stated he had found the alloys to possess even better characteristics than the authors, with milling speeds possible at 2500 fpm and up to 4000 fpm, in some instances, without lubrication.

The third paper, "Zinc in Aluminum Casting Alloys," was by Donald L. Colwell, Apex Smelting Co., Chicago. Experiments by the author as well as experience of hundreds of foundries show that zinc contents of 2 to 2.5 per cent in copper-silicon aluminum alloys and 0.5 per cent in silicon alloys have no harmful effects on alloy properties. In fact, the alloys may be improved with a zinc content approaching double the present allowable amounts.

Such nominal amounts of zinc in aluminum casting alloys have shown a beneficial effect on mechanical properties and machinability and no adverse affect on castability, corrosion resistance, or physical properties.

He pointed out, however, that care must be taken to guard against magnesium contamination. In the tests, magnesium contents were held below 0.1 per cent because the alloys are susceptible to age hardening which is magnified when magnesium content exceeds that amount.

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Charles Maxwell, Alumicast Division, Christiansen Corp., Chicago, presented a written discussion by Walter Bonsack, Christiansen Corp., which described experience supporting findings of Mr. Colwell. In addition, it was determined that zinc did not affect hot-shortness of the alloys.

At the aluminum and magnesium roundtable luncheon, presided over by W. E. Sicha, Aluminum Co. of America, Cleveland, discussion leaders were R. D. Stay, Reynolds Metals Co., Cleveland, and Carl Hitchcock, C. C. Hitchcock & Sons Inc., Minneapolis. The subject was "Sand Casting Practice for Aluminum and Magnesium Alloys."

Many in attendance joined in discussion of shrinkage and its avoidance, heat treating atmospheres, shell molding and the use of resin-bonded sand cores, and problems in obtaining pressure-tight castings.

The concluding session featured showing of the film, "Effect of Gating Design on Casting Quality." Work for the film was performed by K. Grube, J. H. Jackson, and J. G. Kura, Battelle Memorial Institute, Columbus, O. R. F. Thomson, Research Laboratories Division, General Motors Corp., Detroit, presided, with T. D. Stay, Reynolds Metals Co., Cleveland, as co-chairman. Intrductory remarks were made by Mr. Grube.

This is the third in a series of films showing pouring tests conducted with water in transparent lucite molds. Molds used in the test utilized a gating ratio (area of sprue to runner and gate) of 1-4-4, rounded runner and gate corners, tapered sprue (round or rectangular) with top area three times that of bottom area, rounded corner at junction of sprue and pouring basin, and pouring practice which avoided pouring directly down the sprue and kept lift of ladle close to pouring basin.

The new film deals with the sprue base problem. The use of a well plus runner enlargement in the drag just under the sprue proved the best design in eliminating turbulence and entrapment of air into the mold.

During discussion it was pointed out that test molds had air vents only in cope side of runner. Would aspiration of air occur with vents in drag side, a condition which would exist in sand molds?

It was pointed out that aspiration did not occur with the cope vents in 36 of 45 tests. The sprue base problem is mainly one of turbulence and not aspiration.

In answer to a question as to whether a hemispherical well would be better than a cylindrical well, it was stated that it does not slow metal velocity and consequently does not get rid of turbulence as quickly. The sharp angled cylinder shape does a better job even though it seems to be contrary practice to the recommended rounding off of other gating system corners.

GRAY IRON SHOP COURSE

SCRAP control by sampling was discussed at the first of two gray iron shop course session. It was under the joint chairmanship of K. H. Priestley, Vassar Electroloy Products Inc., Vassar, Mich., and E. J. Burke, Hanna Furnace Corp., Buffalo.

Opening the discussion, R. W. Gardner, Dearborn Iron Foundry, Ford Motor Co., Dearborn, Mich., outlined the method in use for some time in his foundry. The primary object of any control program is to prevent the production of defective castings. Men in charge of the program must have a thorough familiarity with all the causes responsible for defects, which may arise from a single, or from a combination of causes. In some instances the cause of the defect is apparent at first glance. In other instances the diagnosis may be complex. Several slides illustrated a number of typical defects. Comment by the speaker covered the diagnosis and the suggested remedy. Other slides illustrated the cards used in the control and checking program.

Chairman Burke, while commending the speaker for the excellence of the presentation, directed attention to the fact that there is considerable difference between the operation of a production foundry and a jobbing foundry, particularly a small jobbing foundry where long-run jobs are the exception. Replying to a question from the floor Mr. Gardner discussed the subject of foundy sand, particularly in relation to the effect of permeability and moisture content on warpage and surface hardness of the castings.

H. H. Wilder, Vanadium Corp. of America, Detroit, and Carl Harmon, Hanna Furnace Corp., Buffalo, discussed "Mechanics of Tuyeres" at the second gray iron shop course, under the joint chairmanship of W. W. Levi, Lynchburg Foundry Co., Radford, Va., and E. J. Burke, Hanna Furnace Corp.

Mr. Wilder outlined the purpose and operation of tuyeres in a cupola, also the necessity of keeping them open. Result of a recent survey indicated there is wide divergence of opinion among foundrymen over size and shape of the tuyeres in relation to optimum melting capacity of the cupola. Mr. Harmon agreed to the lack of unanimity of opinion among cupola men. He described and illustrated a special type tuyere which has proved highly efficient in a battery of cupolas in operation 16 hours per day.

Water Cooled Copper Tuyere

Replying to a request from the floor W. W. Levi described and illustrated the water-cooled copper tuyere installed in a cupola in the Radford foundry. Each tuyere has an area of 56.5 sq in. and weighs 325 lb. Another member stated he would like to hear more of the functions of a tuyere and less of the construction and application. A question on whether there was any marked difference in the application of a hot or cold blast brought the reply that where the conditions are favorable, the hot blast produces hotter iron with a lower sulphur content. Referring back to the water-cooled tuyere Mr. Levi stated that in the original horizontal position small amounts of slag occasionally entered. Later the tuyere was tipped up slightly at the back.

W. H. White, Jackson Iron & Steel Co., Jackson, O., related experience with blast furnace tuyeres which induced him to apply the same system in the cupola. In opposition to Mr. Harmon's preference for a continuous tuyere he claimed that the blast furnace method of leaving a space between the tuyeres showed equally favorable results in the cupola. Air entering through each tuyere has a chilling effect on the material immediately in front of it. The area between the tuyeres remains bright. By shutting off the air temporarily in any given tuyere, the area in front gradually is restored to brightness.

Speaking in a general way a member stated that, in his opinion, the shape, size and position of the tuyeres was a factor of relatively minor importance. Iron has been melted in furnaces with one tuyere and with a whole row of tuyeres. The only really important factor is the introduction of the correct amount of air in relation to the amount of coke in the charge. Many cupola operators, he indicated, are not sufficiently familiar with the principles underlying the proper operation of a cupola.

Editor's Note: Reports on other technical meetings held during the International Foundry Congress will be presented in the July issue.

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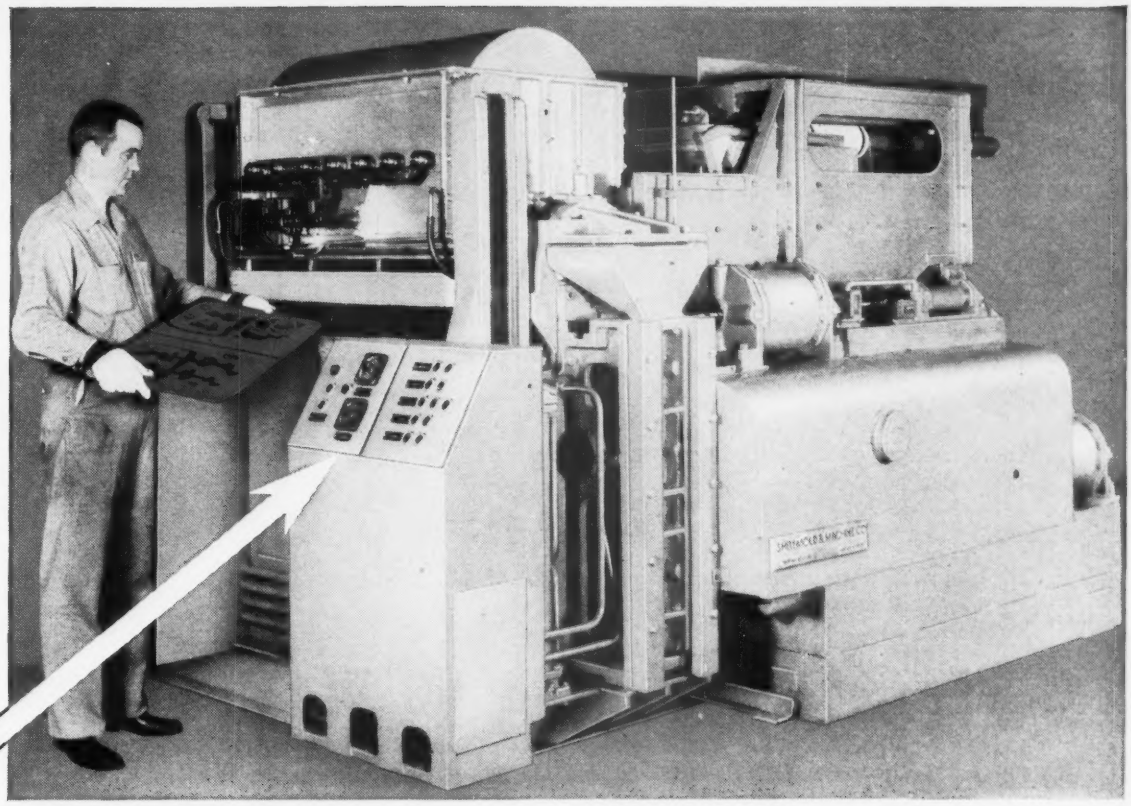

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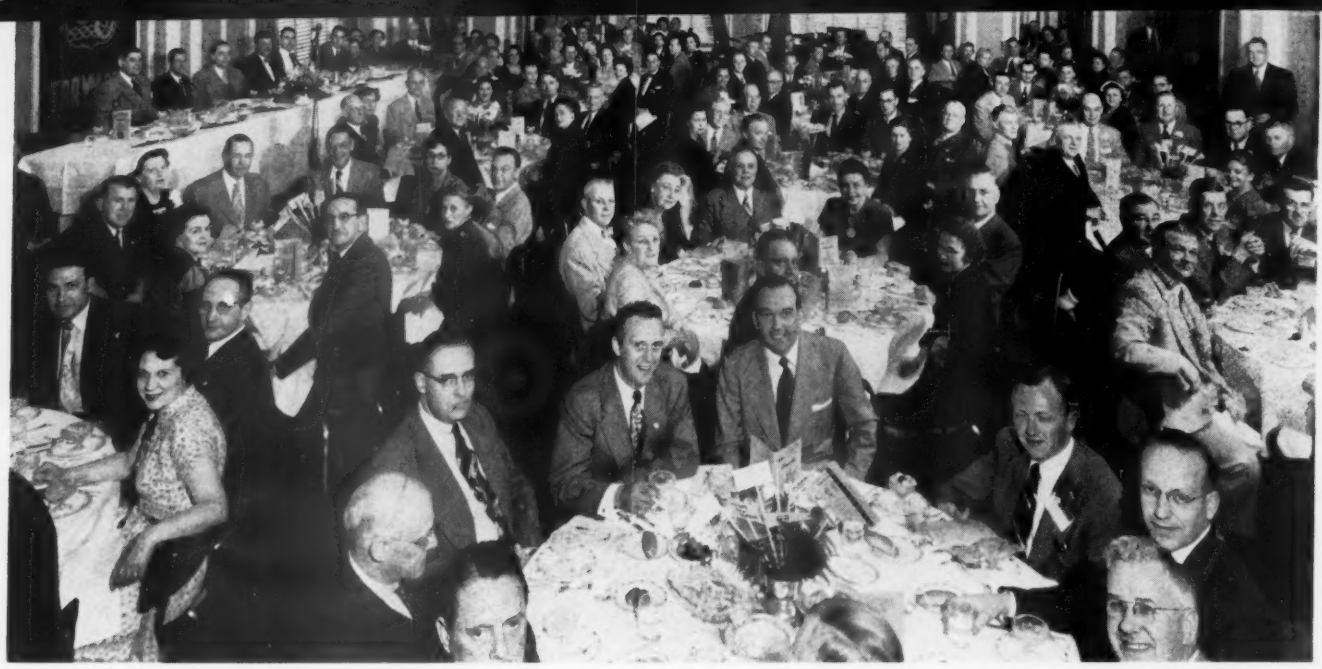


Largest attendance in history marked the annual dinner of the Non-Ferrous Founders' Society at Atlantic City, May 1

NONFERROUS FOUNDERS HOLD ANNUAL MEETING

REPORTS made at the annual meeting of the Non-Ferrous Founders' Society at the Traymore Hotel in Atlantic City, May 1, indicate the society is growing consistently, not only in membership and financial position, but also in accomplishment among government agencies and in service to the industry.

The only foundry branch in a government agency is in the Copper division of the National Production Authority. This efficient group is composed of experienced founders. The Castings and Forgings Division of the Office of Price Stabilization has been headed by founders from the nonferrous industry.

In industry service, the society's cost manual is being revised for small, medium and large foundries and should be in print within 90 days. All present services will be retained and expanded.

Chapters, now established in 14 centers, are expanding and becoming more helpful in carrying on national objectives. More chapters will be established in the near future.

The membership concurred in a suggestion that the society consider a plan for life and welfare insurance in which any member who so desires may participate. Such a plan would allow the very small shops a worthwhile saving.

Discussion of the effect of a new round of wage increases showed that the industry as a whole could not absorb more such increases. An industry survey will be made within 60 days to establish a future base for either industry or individual ceiling price increases. Tabulation of this survey will be done by independent accountants. In this same survey it also was suggested by the members that information be sought for establishing an industry profit basis which could be used by individual members for excess profits tax relief.

Members instructed the officers and the board of directors to take all possible steps to alleviate the burden of all restrictive controls this year.

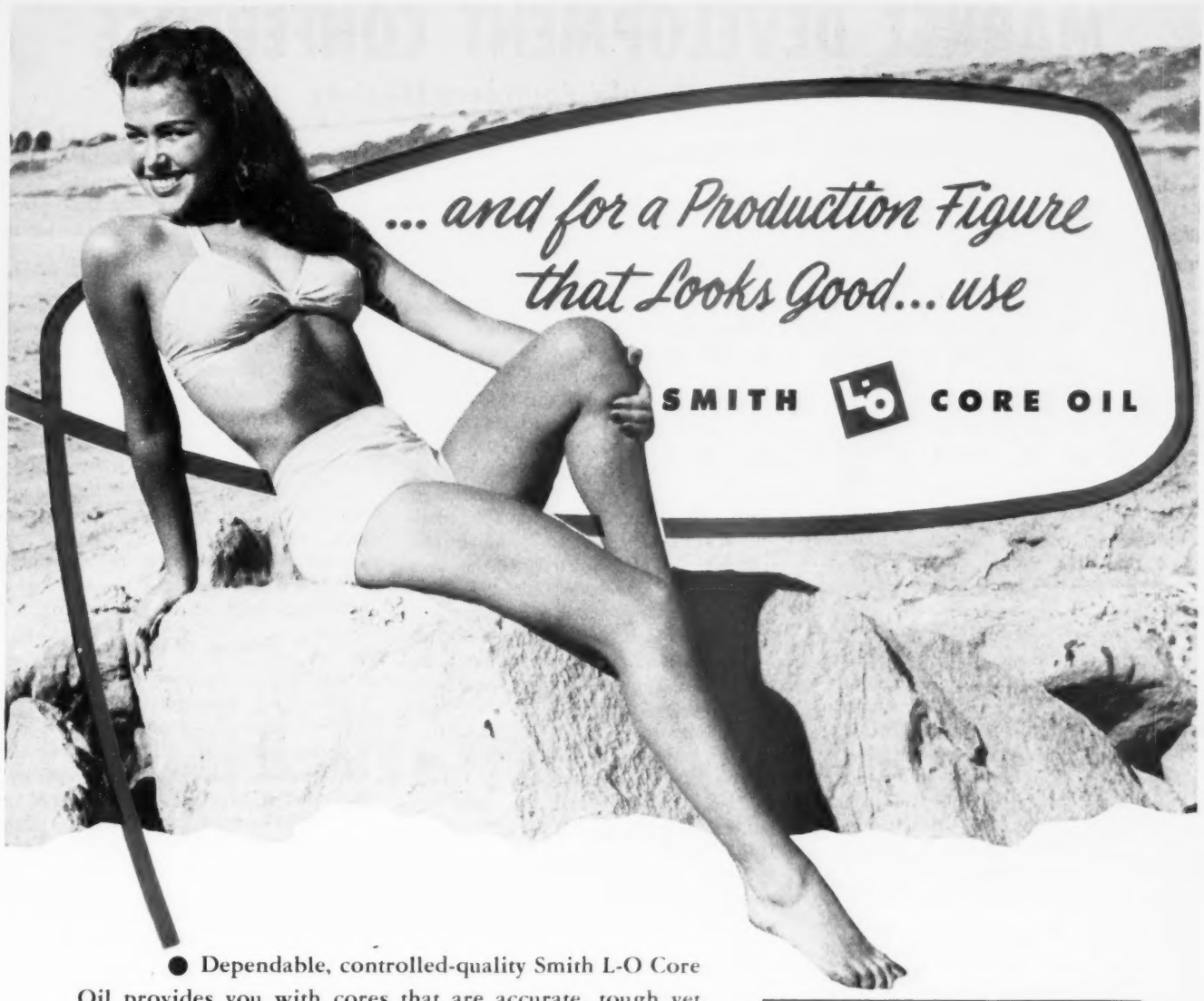
At the close of the annual meeting, the executive committee elected the following officers for the 1952-53 administrative year: President, L. H. Durdin, Dixie Bronze Co. Inc., Birmingham; first vice president, Robert Langsenkamp, Langsenkamp-Wheeler Brass Works Inc., Indianapolis; second vice president, Arthur Fischer, Fischer Castings Co., Plainfield, N. J. In addition to the officers, the present executive committee consists of: William H. Gluntz, Gluntz Brass & Aluminum Foundry Co., Cleveland; Henry J. Hodes, Prier Brass Mfg. Co., Kansas City, Mo.; E. T. Korten, Reliable Castings Corp., Cincinnati; and J. D. Zaiser, Ampco Metal Inc., Milwaukee.

L. H. DURDIN
President

Walter Kenny, Knapp Foundry Co., Guilford, Conn., succeeds as director Harry F. Sweitzer, I. S. Spencer's Sons Inc., Guilford, Conn. S. O. Swangren, Dorchester Brass & Aluminum Co., Boston, was elected for a two-year term due to resignation of Walter M. Clark, now with NPA.

The annual dinner, which followed the meeting, attracted the largest crowd in the history of the society. Jim Wolfe, with a slight assist from Ruth Windsor way down in Arkansas, had prepared decorations and a program that emphasized the political atmosphere. Table decorations consisted of a centerpiece of political banners in miniature insisting "It's time for a change" and bringing out candidates and platform of new society officers. The program, which must have required plenty of work, included buttons of six leading presidential candidates, and gave the menu in political parlance that became apparent only as the food was served.

After Don Zaiser introduced the new officers, Bill Meissner spoke briefly about the NPA foundry branch he heads, and Earle A. Buckley gave some inside secrets on the fine art of letter writing.



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MARKET DEVELOPMENT CONFERENCE

Held by Malleable Founders' Society

By FRANK G. STEINEBACH
and EDWIN BREMER
FOUNDRY

THE third market development conference for executives and sales personnel of the malleable castings industry, was held Apr. 10-11 at Case Institute of Technology, Cleveland, under the joint sponsorship of the Malleable Founders' Society and Case. The program, arranged by the Market Development Committee of the society, included a study of many sales problems confronting the industry, and an interesting look at a number of materials which compete in some manner with malleable castings. Because Roy Hobson, National Malleable & Steel Castings Co., Cleveland, and chairman of the committee was ill, Don L. Boyes, Central Foundry Division, General Motors Corp., Saginaw, Mich., presided at the sessions.

Elmer Hutchisson, acting president of Case, welcomed the group and outlined the objectives of the institution in preparing men for industry. The principal objectives are to train students who have the following qualifications: Ability to write well, speak well and communicate ideas through the graphic arts; sense of responsibility to the stockholders and the community; understanding of basic science and basic engineering; knowledge of practical economics, and ability to work with other people.

Need More Research

In considering the "Status of Our Industry," Cal C. Chambers, Texas Foundries Inc., Lufkin, Tex., and president of the society, indicated that the malleable industry has not enjoyed quite the growth in recent years that might have been expected in relation to the development of the economy in the United States. Contrasted with this there has been a substantial increase in the use of pearlitic malleable castings. Much interest has been developed in the possible use of ductile iron, and Mr. Chambers indicated this material may offer possibilities similar to those which have been developed in pearlitic malleable. Mr. Chambers indicated that the industry should eagerly embrace any development which will expand the use of components which may be produced by malleable foundries.

Mr. Chambers emphasized the need for greater attention to research, and stressed the importance of providing a better product at a lower price. He stated that a more aggressive market development and publicity program should be undertaken by the industry. While great progress has been made, much remains to be done in the field of improved working conditions.

A brief discussion of the technical phases of ductile iron and an indication of possible fields for that material featured a talk by A. P. Gagnebin, International Nickel Co., New York. He indicated that approximately 50,000 tons of ductile iron were melted in 1951, and that 170 companies are licensed to produce the material in the United States and Canada. Mr. Gagnebin said the malleable foundry industry is well equipped to produce ductile iron and has the sales personnel familiar with the various types of application where the material can be used.

F. Kermit Donaldson, executive vice president, Steel Founders' Society of America, Cleveland, described the self analysis which that industry made following World War II. From this the industry developed a forward-looking program to inform manufacturers of advantages of designing and building with steel castings. The work was concerned with impressing those advantages particularly on design engineers; stimulating sales by producing requests from engineers for counsel from steel foundries; distributing useful information on steel castings; and helping counteract aggressive efforts of competitive industries.

Mr. Donaldson stated that too often castings have been sold on the basis of properties and specifications, and that more stress has been placed on a test bar than on design requirements. To be successful today, the industry must sell quality foundry engineered cast parts designed and produced for definite end uses. The part must be carefully tailored, of highest quality, and at a price which reflects basic and sound costing methods and are fair to producer and consumer alike. Serious product design and redesign study provide the following advantages, according to Mr. Donaldson: Better deliveries, increased production, lower man-hours, lower costs, lower prices and a raised profit level, and increased good will.

A Lincoln Electric Co. movie on welding was shown. R. W. Thompson, Transue & Williams Steel Forging Corp., Alliance, O., discussed briefly the methods of manufacture and properties of forgings, and then presented a film produced by that company. The speaker stressed the point of studying the part to determine if even slight design changes can result in lower costs.

J. E. Stanton, divisional purchasing agent, Ford Motor Co., Detroit, presented an interesting paper on what can be expected from the purchasing agent and the salesman. He indicated that the fundamentals of good salesmanship continue to be violated. The need for the salesman having knowledge of the processes employed by his company was stressed. Also, the speaker pointed out that the salesman is doing a job of selling when he looks after an order already received.

Critical of Industry

Charles A. Chayne, vice president, engineering, General Motors Corp., Detroit, was somewhat critical of the foundry industry as a producer of materials for the automotive industry. He pointed out that the producers of automobiles must have the dollar sign foremost, and that the use of materials fluctuates with service of the component and its price. He indicated greater attention is needed in promoting castings if the automotive engineer is to increase their use.

The second day's session, under the direction of Tom Scanlon, Eastern Malleable Iron Co., was devoted to discussions of a number of topics, including defense business, design, nodular iron, sales training and economic outlook. Defense business was discussed by Don L. Boyes, W. H. Cantwell, Eastern Malleable Iron Co., Wilmington, Del., and Frank E. Shumann, Lehigh Foundries Inc., Easton, Pa.

Mr. Boyes stated that the first consideration is whether there is a need for defense business in a particular foundry. If it is, then past experience in producing such castings should be reviewed and a list made of military materiel in which malleable is employed, such as trucks, jeeps, tanks, guns, ammunition, etc. With that information, management and operating personnel determine what castings are best fitted to the foundry. Next step is to ascertain the military branch which handles the items. He cited the Tank Automotive Center, Washington and Detroit, for truck and tank castings; Small Arms Divisions at the Pentagon and Spring-

(*Concluded on page* 180)

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Foundry STATISTICS

Malleable Iron

(Shipments of castings—net tons[1])

	Shipments—Total	Shipments—For Sale	Unfilled Orders[2]
1950	920,502	512,192	.....
1951			
2 mo.	181,458	109,732	.....
Feb.	88,950	54,915	255,347
Mar.	101,667	60,265	267,169
Apr.	97,276	57,554	276,463
May	100,800	61,373	274,954
June	94,376	57,176	258,144
July	76,826	45,072	263,017
Aug.	90,727	57,164	249,273
Sept.	82,276	48,568	244,575
Oct.	93,884	58,251	238,019
Nov.	88,210	53,682	220,740
Dec.	76,045	45,543	215,134
Total	1,083,545	654,380	.....
1952			
Jan.	87,003	54,988	202,799
Feb.	82,898	50,129	193,061
2 mo.	169,901	105,117	.....

Aluminum

(Shipments of castings—1000 pounds[1])

	Shipments—Total	Sand	Perm. Mold	Die	Unfilled Orders[2]
1950	452,643	154,046	143,821	144,661	.....
1951					
Feb.	50,302	17,420	16,962	15,114	94,581
2 mo.	102,670	35,190	35,786	29,996	.....
Mar.	42,204	15,900	12,771	12,677	100,453
Apr.	40,242	14,455	12,901	12,079	106,077
May	40,487	14,798	13,400	11,692	112,638
June	35,961	13,853	10,323	10,850	112,760
July	27,426	10,739	7,142	8,693	119,461
Aug.	35,531	14,128	10,922	9,526	117,888
Sept.	32,487	13,086	8,829	9,730	122,973
Oct.	35,222	13,950	10,131	10,297	110,382
Nov.	32,367	12,728	8,816	9,926	116,044
Dec.	30,799	12,587	8,387	8,441	112,479
Total	436,049	164,731	131,258	129,404	.....
1952					
Jan.	46,424	18,051	12,236	13,884	109,654
Feb.	44,847	17,451	13,445	13,012	110,327
2 mo.	91,271	36,502	25,681	26,896	.....

Copper-Base Alloy

(Shipments of castings—1000 pounds[1])

	Shipments—Total	Shipments—Sand	Shipments—Perm. Mold	Unfilled Orders[2]
1950	1,022,291	925,495	52,756	.....
Feb.	100,849	90,859	5,746	75,967
2 mo.	207,518	186,340	12,480	.....
Mar.	110,887	100,221	6,405	79,766
Apr.	101,506	91,852	5,802	82,711
May	105,438	95,049	5,986	84,002
June	98,559	88,818	5,358	83,518
July	76,551	69,334	4,064	85,837
Aug.	94,443	84,720	5,097	84,821
Sept.	85,433	76,304	5,161	84,611
Oct.	94,706	84,544	5,845	82,491
Nov.	87,764	78,640	5,661	82,667
Dec.	76,526	69,653	4,639	80,435
Total	1,131,402	1,018,973	65,808	.....
1952				
Jan.	89,616	80,376	6,233	78,316
Feb.	86,429	78,011	5,204	75,279
2 mo.	176,045	158,387	11,437	.....

Magnesium

(Shipments of castings—1000 pounds[1])

	Shipments—Total	Shipments—For Sale	Unfilled Orders[2]
1950	12,314	11,582	....
1951			
Feb.	2,416	2,112	10,878
2 mo.	4,735	4,145	....
Mar.	2,156	2,058	12,196
Apr.	2,267	2,161	12,191
May	2,334	2,206	12,867
June	1,758	1,642	14,331
July	1,676	1,557	15,528
Aug.	2,270	2,135	16,095
Sept.	2,010	1,931	16,407
Oct.	2,371	2,300	16,143
Nov.	2,774	2,461	15,550
Dec.	2,220	2,098	14,729
Total	25,583	24,089	.....
1952			
Jan.	3,569	3,083	14,047
Feb.	3,368	2,940	14,459
2 mo.	6,937	6,023	....

Foundry Production Workers

Estimated Number

	Feb. 1952	Jan. 1952	Feb. 1951
Gray Iron	148,200	150,500	161,000
Malleable	26,400	27,000	26,800
Steel	66,500	67,300	55,200
Nonferrous	92,900	92,700	94,500

Average Weekly Earnings

	Feb. 1952	Jan. 1952	Feb. 1951
Gray Iron	$68.22	$70.98	$69.90
Malleable Iron	70.35	70.68	70.89
Steel	76.58	77.28	74.48
Nonferrous	76.70	77.79	72.70

Average Weekly Hours

	Feb. 1952	Jan. 1952	Feb. 1951
Gray Iron	40.2	41.8	42.7
Malleable Iron	39.7	40.0	42.5
Steel	42.9	43.2	43.2
Nonferrous	41.8	42.3	42.0

Labor Turnover Rate (Jan.)

(Per 100 employees)

	Total Accession	Total Separation	Quit	Layoff
Gray Iron	3.6	3.8	2.0	0.8
Malleable Iron	2.9	5.3	2.1	2.3
Steel	5.6	4.4	2.9	0.2
Nonferrous	5.1	3.5	2.1	0.7

Source: Bureau of Labor Statistics

Gray Iron Castings—Shipments

(Net tons[1])

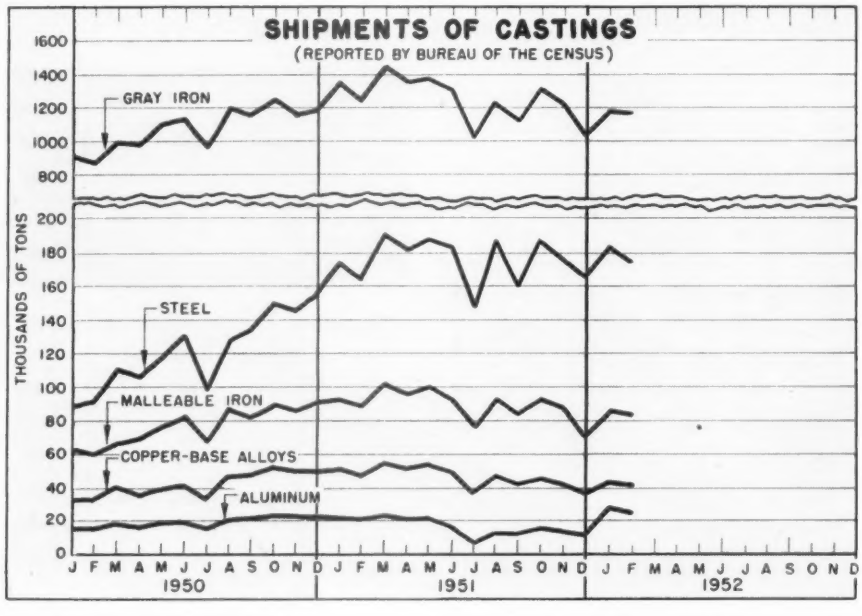
	All Castings—Total	All Castings—For Sale	Miscellaneous Castings—Total	Miscellaneous Castings—For Sale	Heavy Steel Ingot Molds—Total	Heavy Steel Ingot Molds—For Sale	Chilled Railroad Car Wheels—Total	Chilled Railroad Car Wheels—For Sale	Pressure Pipe & Fittings—Total[3]	Soil Pipe & Fittings—Total[3]	Unfilled Orders[2] Total
1950	12,905,562	6,880,352	8,117,748	3,415,281	2,308,661	1,043,590	514,074	456,402	1,203,762	761,317	.....
1951											
Feb.	1,234,226	684,928	811,724	369,932	193,648	91,598	49,423	43,967	117,141	62,290	2,391,843
2 mo.	2,598,537	1,447,335	1,687,161	775,795	422,472	195,073	105,469	93,032	248,920	134,515	.....
Mar.	1,440,149	818,473	920,802	427,162	231,853	114,858	62,282	57,241	144,620	74,592	2,389,659
Apr.	1,363,041	766,735	880,381	403,619	217,970	106,417	61,993	54,002	134,302	68,395	2,336,926
May	1,396,236	796,053	897,913	418,950	225,129	112,145	65,721	57,485	139,854	67,619	2,228,596
June	1,308,987	742,794	847,024	395,329	216,620	108,042	58,620	52,700	121,851	64,872	2,162,152
July	1,028,812	568,126	653,656	301,749	200,764	97,575	40,792	35,202	88,217	45,383	2,208,116
Aug.	1,218,832	697,952	779,838	378,042	222,721	109,257	50,127	44,507	115,284	50,862	2,144,587
Sept.	1,114,789	625,511	704,657	328,331	204,856	96,011	45,467	41,360	111,893	47,916	2,055,392
Oct.	1,301,681	732,764	815,815	382,405	244,556	115,738	53,172	46,483	130,636	57,502	1,983,307
Nov.	1,183,833	674,139	737,971	348,991	222,665	107,569	48,759	43,141	129,766	44,672	1,933,972
Dec.	1,032,799	582,614	646,352	309,696	204,911	94,857	41,594	38,119	108,767	31,175	1,847,065
Total	14,987,696	8,449,515	9,571,570	4,469,069	2,624,517	1,257,542	633,996	563,272	1,474,110	699,000	.....
1952											
Jan.	1,199,285	694,498	745,548	359,806	225,704	110,263	57,155	53,551	125,729	45,149	1,800,905
Feb.	1,155,143	654,833	733,067	348,885	219,251	105,918	50,444	47,649	107,669	44,712	1,766,434
2 mo.	2,354,428	1,349,331	1,478,615	708,691	444,955	216,181	107,599	101,200	233,398	99,861	.....

Steel Castings—Shipments

(Net tons[1])

	All Castings—Total	All Castings—For Sale	All Castings—Railway Specialties	Carbon Steel—Total	Carbon Steel—For Sale	Carbon Steel—Railway Specialties	Alloy Steel—Total	Alloy Steel—For Sale	Alloy Steel—Railway Specialties	Unfilled Orders[2] Total
1950	1,459,382	1,042,884	261,357	1,081,162	788,619	243,215	379,220	254,265	18,142	.....
1951										
Feb.	163,976	117,156	42,565	126,293	93,461	36,793	37,683	23,695	5,772	706,989
2 mo.	338,032	241,158	85,370	261,389	191,658	74,583	76,653	49,500	10,787	.....
Mar.	190,665	134,184	44,196	148,884	107,745	39,492	41,781	26,439	4,744	779,717
Apr.	181,908	129,059	41,545	139,948	102,367	37,553	41,960	26,692	3,992	846,947
May	189,232	131,102	39,845	143,201	101,363	35,511	46,031	29,739	4,334	881,702
June	184,424	131,219	42,337	141,538	103,090	38,200	42,886	28,129	4,137	895,054
July	147,251	100,141	27,585	111,964	78,034	24,516	35,287	22,107	3,069	929,978
Aug.	177,096	128,981	41,763	130,913	99,732	36,086	46,183	29,249	5,677	944,211
Sept.	160,695	116,658	35,500	120,632	89,771	33,086	40,063	26,887	2,414	918,038
Oct.	189,929	139,953	39,984	138,610	104,449	36,488	51,319	35,504	3,496	891,508
Nov.	176,728	131,276	35,034	126,544	95,180	31,099	50,184	36,096	3,935	865,029
Dec.	165,110	123,448	33,213	119,762	89,298	29,341	45,348	34,150	3,872	846,436
Total	2,100,970	1,507,179	476,372	1,583,375	1,162,687	415,955	527,695	344,492	50,457	.....
1952										
Jan.	183,738	139,488	37,091	133,985	102,265	31,806	49,753	37,223	5,285	869,299
Feb.	174,035	133,205	32,719	125,484	94,969	28,251	48,551	38,236	4,468	824,068
2 mo.	357,773	272,693	69,810	259,469	197,234	60,057	98,304	75,459	9,753	.....

[1] Source: Bureau of the Census. [2] All cast iron pipe is shipped for sale. [3] For sale only.



Index of Foundry Equipment Orders

Foundry Trades Only

(Net Orders Closed, New Equipment)

	1951	1952
Jan.	668.0	404.5
Feb.	638.6	200.4
Mar.	599.0	310.0
Apr.	490.1	....
May	431.7	....
June	393.2	....
July	390.3	....
Aug.	404.5	....
Sept.	346.5	....
Oct.	372.4	....
Nov.	305.5	....
Dec.	230.5	....

Note: Figures are percentages of the base period 1937-1939 taken as 100 per cent (monthly average). Source: Foundry Equipment Manufacturers Association.

Coke Production and Consumption

(Net tons*)

	Production	Consumption Total	Consumption By Foundries
1950	72,718,038	73,373,618	3,523,396
1951			
Feb.	6,008,154	6,045,800	293,169
2 mo.	12,819,463	12,831,998	626,360
Mar.	6,683,119	6,697,525	299,267
Apr.	6,471,316	6,335,793	357,018
May	6,730,122	6,716,780	367,946
June	6,567,640	6,638,043	324,758
July	6,629,863	6,495,585	301,447
Aug.	6,768,161	6,674,495	299,027
Sept.	6,470,658	6,366,969	274,017
Oct.	6,742,767	6,727,211	292,737
Nov.	6,501,098	6,562,279	272,338
Dec.	6,738,759	6,821,446	249,490
Total	79,122,966	78,868,124	3,664,404
1952			
Jan.	6,804,106	6,760,011	261,148
Feb.	6,366,721	6,420,062	250,321
2 mo.	13,170,827	13,180,073	511,469

Ingot Brass and Bronze

(Shipments in net tons)

	1951	1952
Jan.	28,416	28,315
Feb.	27,168	24,211
March	31,997	23,890
Apr.	30,472	.....
May	33,267	.....
June	33,817	.....
July	32,016	.....
Aug.	25,285	.....
Sept.	22,285	.....
Oct.	23,124	.....
Total for year	332,378	.....

Zinc-Base Alloy

(Shipments of castings—1000 pounds[1])

	Shipments—Total	Shipments—For Sale	Unfilled Orders[2]
1950	536,398	341,833	.....
1951			
Feb.	42,562	28,250	93,605
2 mo.	87,522	59,053	.....
Mar.	44,218	27,959	100,652
Apr.	43,513	28,565	101,949
Total, 1951	450,375	291,796	.....
1952			
Jan.	38,027	24,974	70,262
Feb.	34,440	23,139	70,034
2 mo.	72,467	48,113	.....

Iron and Steel Scrap Consumption

(Gross tons*)

	All Scrap—Total	All Scrap—Purchased	By Types of Furnace: Cupola—Total	Cupola—Purchased	Air—Total	Air—Purchased	Electric—Total	Electric—Purchased
1949	49,281,000	22,922,000	7,968,000	4,175,000	801,000	276,000	4,239,000	2,608,000
1950	61,497,000	29,403,000	9,474,000	4,666,000	1,118,000	407,000	6,385,000	3,828,000
1951								
Jan.	5,975,382	3,010,300	1,009,142	533,705	110,004	41,116	684,484	435,633
Feb.	5,337,562	2,691,692	936,918	492,395	101,233	38,135	627,308	398,814
Mar.	6,187,520	3,100,622	1,084,325	558,833	108,513	39,260	728,786	463,371
Apr.	5,987,947	3,013,527	1,029,069	545,897	103,458	37,973	704,416	457,521
May	6,096,678	3,087,313	1,063,281	568,198	111,914	39,312	734,483	484,878
June	5,693,402	2,847,856	972,949	517,604	108,740	39,454	693,636	462,092
July	5,298,644	2,581,856	747,864	393,254	80,903	29,858	632,782	421,689
Aug.	5,614,535	2,721,287	918,180	487,085	104,809	37,592	720,020	475,190
Sept.	5,377,491	2,585,665	811,332	427,035	93,166	33,640	688,941	460,446
Oct.	5,869,590	2,826,221	951,406	504,804	102,950	38,534	750,915	489,217
Nov.	5,596,368	2,699,556	847,991	451,591	90,302	33,795	738,589	489,999
Dec.	5,483,089	2,656,536	738,150	398,538	87,748	32,430	687,559	450,155
Total	68,518,208	33,822,431	11,090,607	5,878,939	1,203,740	441,099	8,391,919	5,389,005
1952								
Jan.	5,837,011	2,788,426	846,891	449,935	101,211	38,150	743,233	470,126

Pig Iron Production and Consumption

	Production**—Total	Production**—Foundry	Production**—Malleable	Production**—Basic	Production**—Low Phos. Intermediate Low Phos. & Bessemer	Consumption*—Total	Consumption*—Cupola	Consumption*—Air	Consumption*—Electric
	(Standard grades—1000 net tons)					(By type of furnace, 1000 gross tons)			
1950	64,589.1	2,870.4	3,034.2	50,450.5	8,234.0	58,416	5,475	319	326
1951									
Mar.	5,919.3	267.9	276.5	4,647.5	727.5	5,406	550	33	15
3 mo.	16,805.8	806.6	735.8	13,184.5	2,079.0	15,498	1,584	94	36
Apr.	5,812.2	259.1	261.0	4,575.8	716.1	5,281	516	31	11
May	6,104.9	282.0	259.4	4,777.0	786.5	5,522	533	31	11
June	5,911.3	254.2	276.5	4,631.9	748.7	5,348	486	30	11
July	5,994.8	280.4	250.0	4,702.8	761.6	5,317	378	23	10
Aug.	5,988.6	252.7	254.4	4,723.3	758.2	5,358	465	30	11
Sept.	5,811.6	257.7	243.7	4,576.8	733.4	5,266	431	27	12
Oct.	6,112.6	260.6	299.4	4,777.4	775.2	5,601	489	31	14
Nov.	5,824.5	285.5	269.0	4,532.1	737.9	5,287	448	29	9
Dec.	5,898.1	247.4	257.5	4,653.0	740.2	5,282	401	28	11
Total	70,264.5	3,186.2	3,169.0	55,134.1	8,774.8	63,760	5,731	354	136
1952									
Jan.	5,964.3	233.1	285.8	4,672.3	773.1	5,452	466	29	14
Feb.	5,701.8	245.2	261.4	4,496.9	698.3	....	....	....	....
Mar.	6,226.2	250.3	273.1	4,895.9	806.9	....	....	....	....
3 mo.	17,892.3	728.6	820.3	14,065.1	2,278.3				

* Source: U. S. Dept. of Interior, Bureau of Mines. ** Source: American Iron & Steel Institute. [1] Source: Bureau of the Census. [2] For sale only.

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(*Concluded from page 174*)

field Armory, Springfield, Mass., for guns and ammunition; Chemical Warfare at Edgewood Arsenal, Edgewood, Md., Dallas and Chicago, for those in the chemical phases of warfare.

Mr. Boyes said that since January, 1951 his firm had obtained about 30 conversion contracts amounting to 1300 tons a month and 43 government contracts requiring about 4300 tons a month. The conversion work is that in which some type of malleable replaces some other type of material. On those he mentioned wheel hubs converted from forgings, covers from die castings, and tank turret mechanism parts from steel castings. He said that work is being done on converting some parts used in incendiary bomb clusters weighing 75 lb from forgings to pearlitic malleable.

Frank Shumann described the activity of his firm and Auto Specialties Mfg. Co. during World War II in research and development for converting manufacture of mortar shells from bar stock to steel castings. This led to obtaining sizable defense contracts. He pointed out that, in case of all-out war, shortage of bar stock and machines again would result in use of castings for that purpose. He also said that ballistic studies on fragmentation now nearing completion would lead to a change in materials for shells and projectiles, with the possibility of malleable iron being found suitable. In his opinion ammunition has a great potential for the malleable industry, but research and development are required to show applicability of malleable iron. When that is accomplished, the idea must be sold to the particular military agency—no mean task.

Mr. Cantwell said that every malleable foundryman should be alert to specification changes which will lead to use of malleable iron. Many small firms are not aware of their properties and possibilities, and time spent in educating them on such points will lead to business for the foundry. To illustrate that point he showed several castings including a leg or foot for outdoor mail post and storage boxes which was converted from stampings, and a trailer hitch converted from steel castings.

Ross Gilmore, Superior Steel & Malleable Castings Co., Benton Harbor, Mich., discussed a design program employed in his firm's plant which has proved profitable. It was established to eliminate losses to other methods of fabrication, and to work with customers to provide designs more amenable to foundry methods. Materials and equipment used include brittle lacquer and various sizes of hydraulic jacks and rams with carefully calibrated gages for ascertaining pressures. Procedure is to coat the casting with brittle lacquer, fasten it to a steel-topped table and then subject it to loads applied by the hydraulic equipment. Cracking of the lacquer indicates stress concentration areas. From those data changes are made in the casting to reduce the stress concentration to a low value.

According to the speaker, cost of equipment is around $20,000. Air-conditioned rooms are required since the brittle lacquer is sensitive to atmospheric conditions. He mentioned that suggestions on redesign of existing castings must be handled diplomatically. Mr Gilmore stated that such investigational work must be charged to the customer or it will become a liability. He also said that data obtained in the work was used in preparing advertising.

J. O. Klein, Texas Foundries Inc., Lufkin, Tex., showed a number of new applications of nodular iron which his firm is producing. He said that this type of material serves excellently for pressure castings, where abrasive wear is encountered and castings have adjacent thick and thin sections. However, production of nodular iron requires close supervision, and experience has to be gained in its production.

W. V. Machaver, Johnson & Johnson, New Brunswick, N. J., spoke on sales training methods, and indicated that in view of today's competition, it is necessary that sales executives possess a broad knowledge of production, markets, advertising techniques, human or social relationships, and company and public relationship. He described the various methods employed to develop those characteristics.

In discussing the economic outlook Eli Shapiro, University of Chicago, predicted a rise in defense spending late this year, continuing through 1953 and early 1954. At the peak it may be around $65 billion, dropping off to $40 to $45 billion in late 1954 and 1955. He said that such spending now is $4 billion a month, and to reach the $60 billion annual figure talked about so much, would require an additional $1 billion a month. However, this appeared unlikely at present due to hesitance of the military to place large orders for many types of materiel for which design changes are in prospect.

LIFE MEMBERSHIPS: Certificates of life membership in the Institute of British Foundrymen are presented by Noel P. Newman (left), Newman-Hender Co., Gloucester, and past president of the IBF, to Dr. James T. MacKenzie, American Cast Iron Pipe Co., and Oliver Smalley, Meehanite Metal Corp. The presentation was made at the AFS annual business meeting at the International Congress

Discussion on Malleable

British Cast Iron Research Association, Alvechurch, Birmingham, England, recently published a 193-page book containing the papers and discussions presented at a conference on malleable cast iron which was held under its auspices at Ashorne Hill in March, 1951. The 17 papers pertain to such phases as mechanization, gating and feeding, hot blast cupola, pulverized fuel-fired furnaces, rotary type furnaces, gaseous annealing, controlled atmosphere furnaces, metal composition and annealing of blackheart malleable, production of whiteheart malleable, and basic refractories.

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AROUND THE COUNTRY

News Reports from . . .

New York

DISTRICT gray iron foundries have lost some of the momentum which appeared to be getting under way early in the spring. There is an atmosphere of uncertainty which is retarding the placing of large commitments and is reflected in caution by gray iron casting buyers generally. This is true also in malleable and nonferrous lines and, were it not for defense requirements, steel foundry operations would be showing some lag.

Gray iron foundries are operating around four days a week; malleable plants at slightly higher, although not at the level of a few weeks ago. Most gray iron jobbing shops have little in the way of backlogs. Malleable shops have not enough to carry them more than three weeks in some instances. Brass shops have little business on hand and even the aluminum foundries are becoming concerned over the decline in their bookings.

All raw materials are in ample supply, except perhaps pig iron, which is in at least adequate supply.

Los Angeles

FOUNDRY activity has continued to show betterment for the second successive month. Improved foundry prospects are attributed to easing of building curbs and relaxation of materials controls.

With the brakes off construction many postponed building projects are coming off the shelf, stimulating demand for castings. Of 1599 commercial construction projects valued at over $726 million approved by NPA for second quarter, 254 projects costing more than $118 million are in California, more than in any other state. Among the large projects to get underway are 62 new schools in Los Angeles, a vast program costing $148 million. Scheduled to start by July is a $45 million, 4000-home construction project at Fontana, Calif., near the Kaiser Steel Corp. mill. Local foundries will also benefit from the Wherry $90 million defense housing project to start soon in San Diego.

New records were set recently by southern California construction activity, with valuation of private construction the highest in 14 months, civil nonresidential construction the highest in 8 months, and industrial construction the second highest monthly amount in history. Valuation of total construction in southern California in March was $109,933,133.

Among the first to benefit from quickening activity were the soil pipe foundries. In the face of the previous building slowdown pipe foundries had reduced output 50 per cent and working shifts from three to one. Now pipe foundries are back on one shift, 8-hour, 5-day work schedules. Melt of gray iron foundries is up about 10 per cent from last month and they are operating at 75 per cent capacity. New pressure is being felt by gray iron foundries for closer delivery of castings and backlog for heavy castings is about six weeks. Nonferrous foundries operating at about 80 per cent capacity also are sharing in the upswing in foundry business.

Steel foundries are encountering increased pressure for castings. One of the largest steel foundries in this district, operating at 100 per cent capacity, increased its shipments 30 per cent last month to meet urgent customer requirements. Higher requirements for steel castings are springing from new activity in utility pipeline projects, refinery enlargements, chemical plants, and electrical equipment manufacturers.

The supply of foundry materials continues to ease. Cast scrap prices have fallen to levels $15 below peak prices of six months ago. When sales are made cast scrap of top quality sells at $40 to $42, about $4-$6 below ceiling. Pig iron is plentiful at ceiling prices. Coke of good quality is abundant and supplies of nickel, molybdenum and copper are easier.

The steel strike had no effect on foundry operations. But since most union foundry workers are represented by the CIO United Steelworkers, ferrous foundrymen expect to face the union across the bargaining table as soon as the steel wage patterns are determined. Foundry workers so far, are content to await the outcome of the steel negotiations before making wage proposals of their own.

Philadelphia

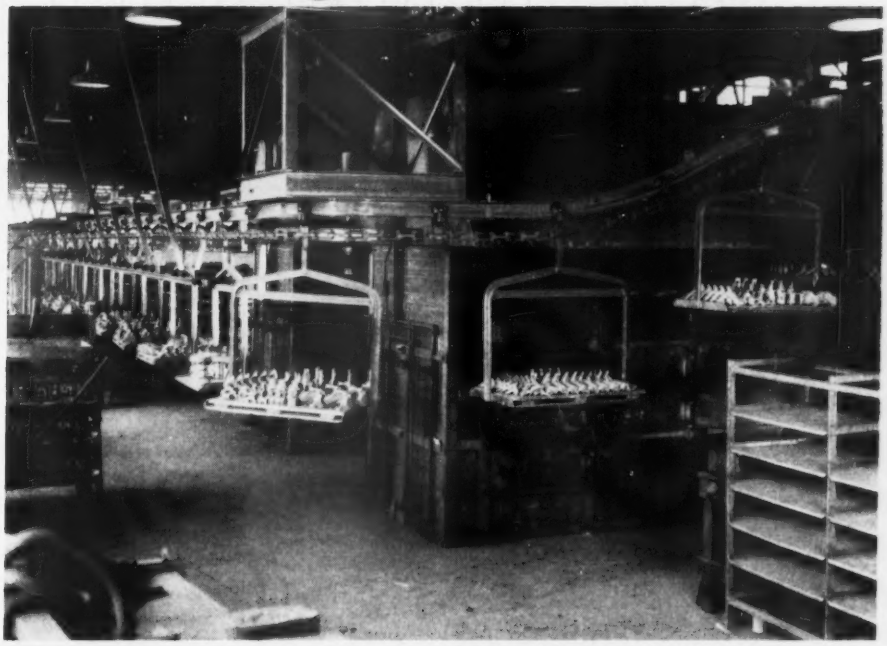
EXCEPT for steel casting shops, foundry operations are still lagging. In gray iron the situation is spotty, with shops making the larger castings operating at around 80 per cent. This means five days although with somewhat reduced forces. Those making smaller castings are not going more than four days a week and some even less.

Machine tool requirements are sliding off at the moment. Machinery specialties appear to be an exception, especially some of the larger units. Pressure pipe foundries are fairly busy, particularly those equipped to augment production with such work as centrifugal liners, special bushings, etc. Soil pipe shops are picking up a little, as a result of seasonal influences, but business is still far from brisk.

Malleable operations are definitely

(*Concluded on page* 186)

Mathews Engineering



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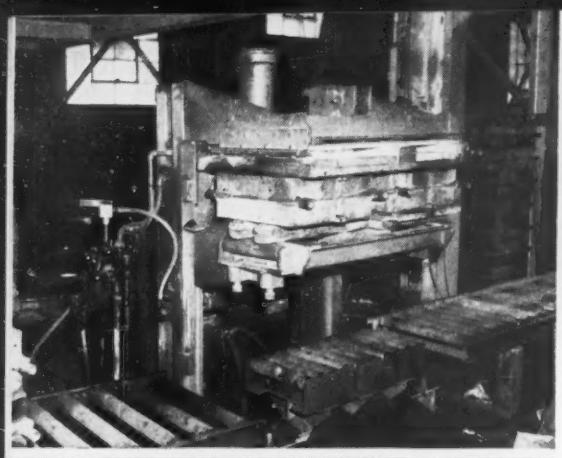

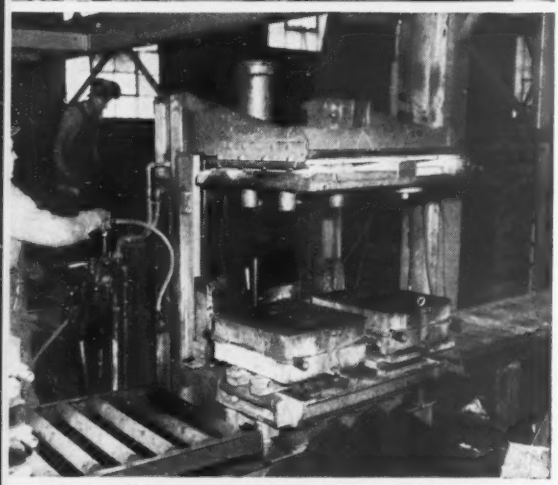

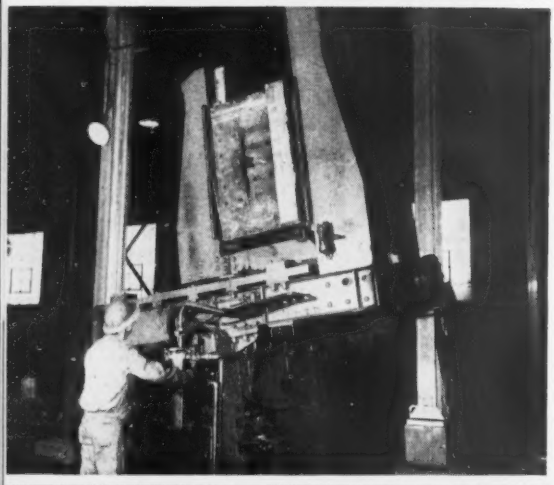

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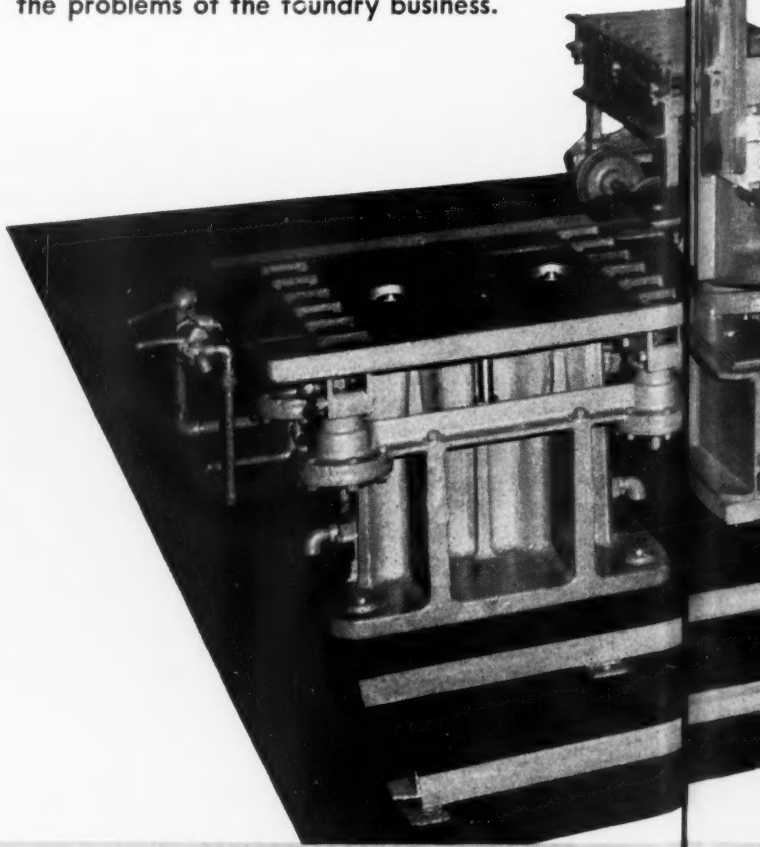

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Perfect Companions to the Type AN Machine. Rollers are an integral part of the machine for roll-off or roll-on — Jolt capacities 1500 to 12,000 lbs.

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(*Concluded from page* 182)

off, averaging possibly four days a week. Railroad equipment builders are taking less and there is lighter demand for fittings. Automotive requirements are proving disappointing and specifications for small castings for light consumer durable lines are barely being sustained. Malleable backlogs average around a month. Nonferrous shops are not doing as well as a month ago, when the average even then was only fair.

Direct defense requirements and defense tooling needs account for much of the activity at the steel foundries. These shops are running five and six days a week, with backlogs of 16 weeks and beyond.

Foundry supplies, such as pig iron, scrap, coke and nonferrous ingots are adequate; ferrous scrap is more than adequate.

FROM the foundryman's point of view changes now being forecast in auto engine materials and manufacturing methods cannot be ignored. Aluminum's potential is great, and current interest in it is higher in the automaking circle than ever before. A revealing compilation by Aluminum Co. of America's Development Division indicates what may be ahead in the next several years.

Feasible aluminum applications per car by 1954 give a total of 214.3 lb and such uses as head, block and crankcase, radiator, wiring, brakes, etc. The figures are not fanciful; it is understood they were derived from consultation with each major automaking company on the aluminum useage its designers and engineers regard as conceivable by 1954. It is not intimated that each company will switch to aluminum for every possible application, but on the strength of those who say they might, the figures have a great deal of significance.

Taking those parts now cast in aluminum and other materials item by item, Alcoa's estimates for 1954 aluminum consumption compared with actual 1950 use are: Pistons 35,000,000 lb against 60,670,000 lb; cylinder heads 23,400,000 lb against 4,570,000 lb; cylinder blocks and crankcases 19,500,000 lb against none currently; clutch housings 5,000,000 lb against 1,330,000 lb; torque converters 25,000,000 lb against 16,670,000 lb; carburetors and fuel pumps 10,000,000 lb against 1,330,000 lb; valve covers and manifolds 3,000,000 lb against 667,000 lb; brakes 7,000,000 lb against 2,000,000 lb. No mention is made in this list of such uses for aluminum as door panels, hood and deck lids, which the Development Division considers to have only a limited potential in the near future.

It has been said that aluminum foundry capacity fails by a large margin to be capable of producing cast parts for only one of the large automakers, let alone the entire industry. Furthermore, as a rebuttal to those who believe large-scale use of aluminum engine castings, for example, is in the cards soon, there are the mammoth gray iron foundry facilities either recently modernized, or newly constructed, by members of the auto industry as visual proof that cast iron is not about to be dropped.

Cost can also be cited as a reason for continuation of cast iron parts, but here the aluminum proponents begin to have good arguments. They say volume requirements of aluminum parts make permanent mold and die casting entirely feasible — and cheap. One idea currently making the rounds among automotive independents is to establish die casting facilities far in excess of a particular company's own needs and offer parts or even entire engines for sale to the others. One aluminum engine, designed for brazed assembly, offers flexibility as to cylinder numbers which might make this approach possible.

Automobile engines have about reached the end of the rope as to horsepower potential. It is regarded as a distinct possibility that horsepower ratings will go the other way if aluminum engines are adopted. The thinking is that smaller and lighter aluminum engines and other car components will permit extremely good performance and adequate speed with much lower horsepowers than are presently required. Compactness of the new engine designs, furthermore, permits entirely new styling concepts, with the engine compartment shortened materially and the passenger compartment lengthened. Wheelbase and overall length, it is believed, can be brought closer to the same figure.

Meetings of Interest to Foundrymen

June 10-13—Institute of British Foundrymen, annual conference, Spa Hotel, Buxton, Derbyshire

June 16-17—Malleable Founders' Society, annual meeting, Homestead, Hot Springs, Va.

June 23-27—American Society for Testing Materials, annual meeting, Statler Hotel, and Hotel New Yorker, New York

July 25—Malleable Founders' Society, western sectional meeting, Drake Hotel, Chicago

Sept. 8-10—American Standards Association, national standardization conference, Museum of Science & Industry, Chicago

Sept. 8-12—Instrument Society of America, annual meeting, Cleveland

Sept. 18-19 — National Foundry Association, annual meeting, Edgewater Beach Hotel, Chicago

Sept. 22-23—Steel Founders' Society, fall meeting, the Homestead, Hot Springs, Va.

Sept. 26-27—Ohio Regional Foundry Conference, Ohio Chapters, AFS, and Ohio State Student Chapter, Ohio State University, Columbus, O.

Oct. 16-17—Gray Iron Founders' Society, annual meeting, Hotel Cleveland, Cleveland

Oct. 16-18—Foundry Equipment Manufacturers Association, annual meeting, Greenbrier, White Sulphur Springs, W. Va.

Oct. 17-18—Michigan Regional Conference, Central Michigan, Detroit, Saginaw Valley, and Western Michigan Chapters, AFS, University of Michigan, Ann Arbor, Mich.

Oct. 20-24—American Society for Metals, National Metal Congress and Exposition, Philadelphia

Oct. 24-25—Northwest Regional Foundry Conference, Oregon, Washington, and British Columbia Chapters, AFS, Multnomah Hotel, Portland, Oreg.

Nov. 13-14—Southwestern Regional Foundry Conference, Texas and Tri State Chapters, AFS, Baker Hotel, Dallas, Tex.

Nov. 19—American Standards Association, annual meeting, Waldorf-Astoria Hotel, New York

Dec. 4-6—American Institute of Mining & Metallurgical Engineers, electric furnace steel conference William Penn Hotel, Pitttsburgh

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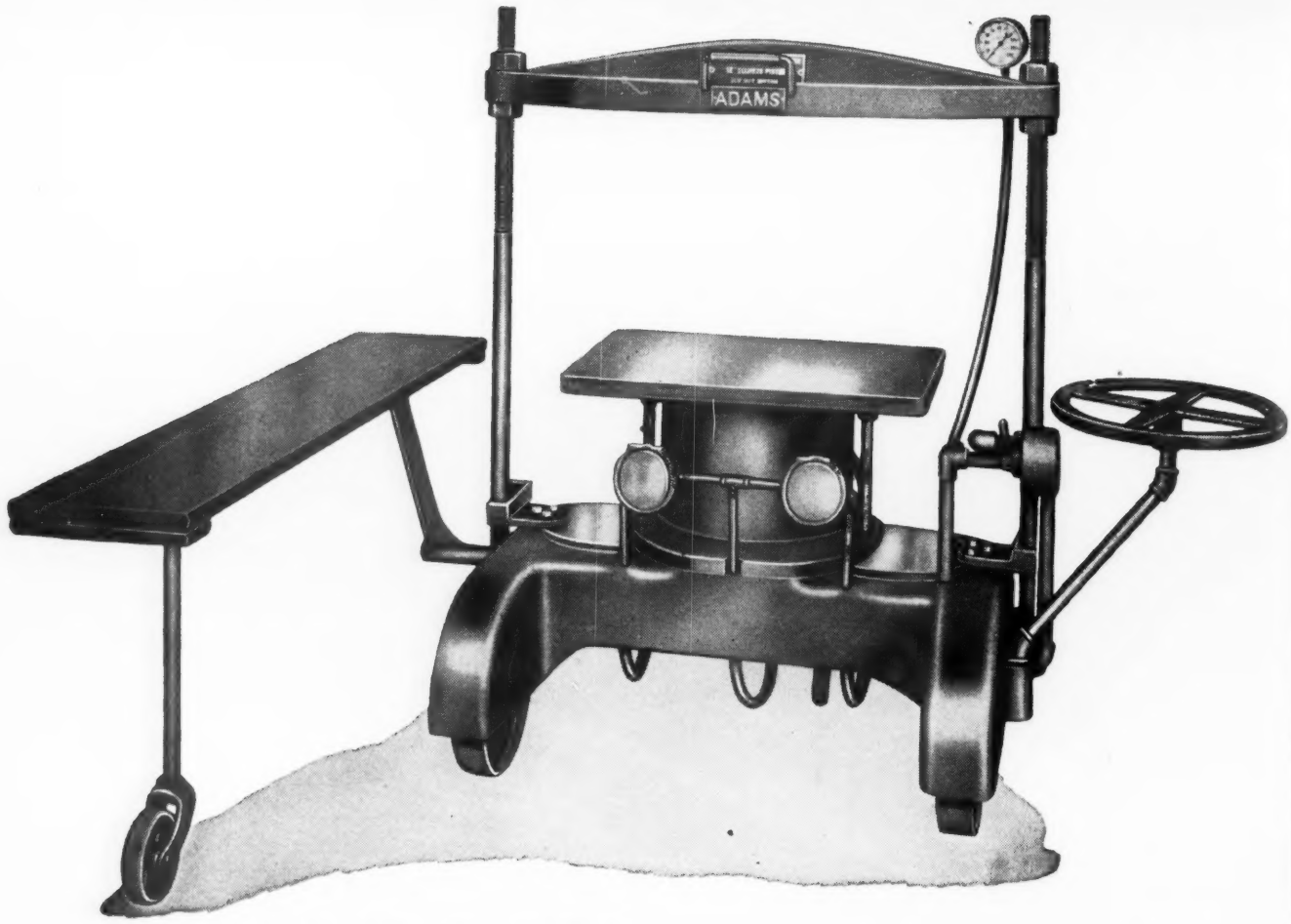

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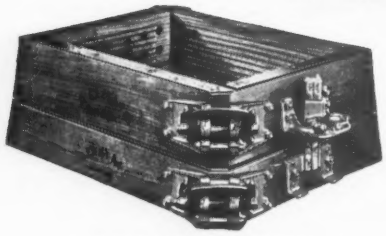

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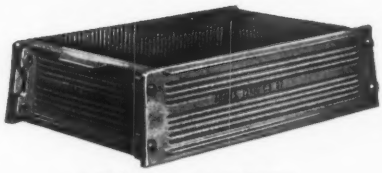

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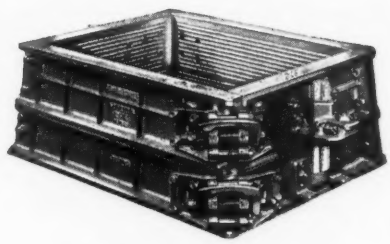

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TENTATIVE SPECIFICATIONS FOR MAGNESIUM-BASE ALLOY SAND CASTINGS

ASTM Designation: B 80—51T

Issued, 1930; Revised, 1931, 1934, 1936, 1938, 1940; 1941, 1944, 1945, 1947, 1949; 1951

Scope

1. These specifications cover magnesium base alloy sand castings designated as shown in Table 1.[1]

Manufacture

2. The materials used shall be such as to produce products that will conform to the requirements as to chemical composition and physical properties prescribed in these specifications.

Heat Treatment

3. The castings may be subjected to such heat treatment as the manufacturer desires to produce material that will conform to the requirements specified. Heat treatment shall be performed on the whole of a casting, never on a part only, and shall be applied in a manner that will produce the utmost uniformity.

Chemical Composition

4. The castings shall conform to the requirements as to chemical composition prescribed in Table 1.

Sampling for Chemical Analysis

5. (a) The samples for chemical analysis of a melt shall be taken by sawing, drilling, or milling a corresponding casting or tension test specimen in such manner as to be representative of its average cross-section. If preferred, an analysis specimen may be poured from each melt of 2000 lb or fraction thereof. The samples shall weigh not less than 50 g.

(b) The saw, drill, or cutter used for taking the sample shall be thoroughly cleaned. No lubricant shall be used in the operation, and the sawings or metal chips shall be carefully treated with a magnet to remove any particles of iron introduced in taking the sample.

Methods of Chemical Analysis

6. The chemical analysis shall be made in accordance with the Standard Methods for Chemical Analysis of Magnesium and Magnesium-Base Alloys (A. S. T. M. Designation: E 35), or Tentative Photometric Methods for Chemical Analysis of Magnesium and Magnesium-Base Alloys (A.S.T.M. Designation: E-35), or by any other approved methods agreed upon by the manufacturer and the purchaser. The analysis may be made spectrographically provided that, in case of dispute, the results secured by Standard Methods E-35 shall be the basis for acceptance.

Table I—Chemical Requirements

Alloy*	Magnesium, per cent	Aluminum, per cent	Manganese, min, per cent	Zinc, per cent	Silicon, max, per cent	Copper, max, per cent	Nickel, max, per cent	Other Impurities max, per cent
AM80A	remainder	7.8 to 9.2	0.15	0.3 max	0.3	0.10	0.01	0.3
AM100A	remainder	9.3 to 10.7	0.10	0.3 max	0.3	0.10	0.01	0.3
AZ63A	remainder	5.3 to 6.7	0.15	2.5 to 3.5	0.3	0.25	0.01	0.3
AZ91C	remainder	8.1 to 9.3	0.13	0.4 to 0.1	0.3	0.10	0.01	0.3
AZ92A	remainder	8.3 to 9.7	0.10	1.6 to 2.4	0.3	0.25	0.01	0.3
M1B	remainder		1.20		0.3	0.10	0.01	0.3

* These alloys formerly were designated as A8, A10, AZ63, AZ91, AZ92 and M1, respectively.

Note 1.—Analysis shall regularly be made only for the elements specifically mentioned in this table. If, however, the presence of other elements is suspected, or indicated in the course of routine analysis, further analysis shall be made to determine that the total of these other elements is not in excess of the limits specified in the last column of the table.

Note 2.—The following applies to all specified limits in this table: For purposes of acceptance and rejection, an observed value or a calculated value obtained from analysis should be rounded off to the nearest unit in the last right-hand place of figures used in expressing the specified limit.

[1] S.A.E. Specifications Nos. 50 and 500 conform to the requirements of alloys Nos. AZ63A and AZ92A, respectively.

Tensile Properties

7. The tension test specimens representing the castings shall conform to the requirements as to tensile properties prescribed in Table II.

Test Specimens

8. (a) The tension test specimens shall be separately cast in green sand and shall be "cast to size" according to the dimensions shown in Fig. 7 of the Tentative Methods of Tension Testing of Metallic Materials (ASTM Designation: E 8) except that the radii at the ends of the reduced section shall be not less than ½ in. They shall not be machined prior to test except to adapt the grip ends to the holders of the testing machine in such a manner as to assure an axial load.

(b) If any tension test specimen is improperly machined or shows flaws upon testing, it may be discarded and another specimen from the same heat or melt used instead. If no additional specimen is available, the manufacturer and the purchaser shall agree on an alternative procedure.

Number of Tests

9. (a) At least one tension test specimen shall be cast from each melt of 2,000 lb or fraction thereof to represent the castings poured from the same melt. If the castings are to be heat treated, the specimens shall be heat treated, with production castings of the same alloy and in the same condition as the specimens. The specimens shall then be tested to judge the ability of their corresponding melts to respond to the type heat treatment to which the specimens were subjected.

(b) Each heat treating furnace charge shall include at least one tension test specimen poured from a production melt. Such specimens shall be of the

Table II—Tensile Requirements

Alloy	Condition	Tensile Strength min, psi	Yield Strength† (0.2 per cent offset), min, psi	Elongation in 2 in., min, per cent
AM80A—	F (as cast)	23000	*	3
	T4 (Solution heat treated)	34000	*	7
	T6 (solution heat treated and artificially aged)	34000	12000	4
AM100A—	T6 (solution heat treated and artificially aged)	34000	17000	*
AZ63A—	F (as cast)	24000	*	4
	T5 (artificially aged only)	24000	11000	2
	T4 (solution heat treated)	34000	*	7
	T6 (Solution heat treated and artificially aged)	34000	16000	3
AZ91C—	F (as cast)	18000	*	4
	T4 (solution heat treated)	34000	*	7
	T6 (solution heat treated and artificially aged)	34000	16000	3
AZ92A—	F (as cast)	20000	*	*
	T5 (artificially aged only)	20000	11000	*
	T4 (solution heat treated)	34000	*	6
	T6 (solution heat treated and artificially aged)	34000	18000	1
M1B—	F (as cast)	12000	*	3

* Not required.

† See Explanatory Note 2.

‡ These alloys formerly were designated as A8, A10, AZ63, AZ91, AZ92 and M1, respectively.

TENTATIVE SPECIFICATIONS FOR MAGNESIUM-BASE ALLOY SAND CASTINGS

ASTM Designation: B 80—51T

Issued, 1930; Revised, 1931, 1934, 1936, 1938, 1940; 1941, 1944, 1945, 1947, 1949; 1951

same alloy and in the same condition as the castings, and shall be tested to judge the quality of the heat treating operation given the furnace charge.

Method of Testing

10. The tension tests shall be made in accordance with the Tentative Methods of Tension Testing of Metallic Materials (A.S.T.M. Designation: E 8).

Note.—The values obtained for the tensile properties covered by these specifications are not seriously affected by variations in speed of testing. A considerable range of testing speed is permissible; however, the rate of stressing to the yield strength should not exceed 100,000 psi per min, and above the yield strength the movement per minute of the head under load should not exceed 0.5 in. per in. of gage length (or distance between grips for specimens not having reduced sections). Care must be exercised, especially when making yield strength determinations, that the speed of testing does not exceed the ability of the strain- and load-indicating equipment to function satisfactorily.

Workmanship and Finish

11. The castings shall be of uniform quality and condition, free from cracks or other injurious defects, and shall be well cleaned before inspection by sandblasting or any other approved process.

Inspection

12. (a) Inspection may be made at the manufacturer's works where the castings are made, or at the point at which they are received, at the option of the purchaser.

(b) If the purchaser elects to have the inspection made at the manufacturer's works, the manufacturer shall afford the inspector representing the purchaser all reasonable facilities, without charge, to satisfy him that the material is being furnished in accordance with these specifications. All tests and inspection shall be so conducted as not to interfere unnecessarily with the operation of the works.

Rejection

13. Castings that fail to conform to these specifications or that show injurious defects revealed by machining operations subsequent to acceptance may be rejected and, if rejected, the manufacturer's responsibility shall be limited to replacing the rejected material without charge to the purchaser. The full weight of the original material rejected shall be returned to the manufacturer.

Explanatory Notes

NOTE 1: Alloy AM80A.—This alloy has a specific gravity of about 1.80. It is used in the ascast, heat-treated, and heat-treated and aged conditions. This alloy will produce castings having the maximum soundness with moderate mechanical properties.

Alloy AM100A.—This alloy has a specific gravity of about 1.81. It is used both in the solution heat-treated condition and in the solution heat-treated and aged conditions. Aging increases the yield strength and hardness and decreases the toughness and elongation.

Alloy AZ63A.—This alloy has a specific gravity of about 1.84. It is used in the ascast, the solution heat-treated, and the solution heat-treated and aged conditions. Its properties are somewhat better and its resistance to salt-water (NACl) corrosion is decidedly better than in the case of alloy AM100A.

Alloy AZ91C.—This alloy has a specific gravity of about 1.81. It should be used for those applications requiring the maximum of strength and hardness as well as ductility. Its mechanical properties in the heat treated and in the heat treated and aged temper are similar to AZ63A, but its Foundry the heat treated and aged temper are similar to AZ63A, but its foundry if the higher resistance to salt water corrosion of the latter composition is not required.

Alloy AZ92A.—This alloy has a specific gravity of about 1.82. It is used where good soundness and mechanical properties are required. The alloy is heat treatable and is then characterized by high strength and hardness. Its resistance to salt-water (NaCl) corrosion is approximately equivalent to that of alloy AZ63A.

Alloy AZ92A in the heat-treated condition ages more rapidly than alloy AZ63A in the heat-treated condition. Under service conditions where the castings attain a temperature of 200 F. or higher, the castings of alloy AZ92A, heat-treated, will gradually change to the heat-treated and aged condition.

Alloy M1B.—This alloy has a specific gravity of about 1.76. It is used principally for aircraft tank fittings where a weldable alloy with high resistance to salt-water (NaCl) corrosion is required.

NOTE 2.—The yield strength of magnesium base alloys is defined as the stress at which the stress-strain curve deviates 0.2 per cent from the modulus line. It may be determined by the "Offset Method" or the "Extension Under Load Method" (the latter is often referred to as the "Approximate Method Without the Stress-Strain Diagram") as described in the Tentative Methods of Tension Testing of Metallic Materials (A.S.T.M. Designation: E 8).

The data in Table III give typical and minimum yield strength values for the various alloys, together with the corresponding unit deformation for use with the "Extension Under Load Method" based on a modulus of elasticity, E = 6,500,000 psi.

Table III—Explanatory Notes

Alloy	Condition	Typical or Minimum	Yield Strength (0.2 per cent offset), min, psi	Unit Deformation, inch per inch of gage length
AM80A—	T6 (solution heat treated and artificially aged)	minimum	12000	0.0038
AM100A—	T6 (solution heat treated	typical	19000	0.0049
	and artificially aged)	minimum	17000	0.0046
AZ63A—	F (as cast)	typical	11000	0.0037
	T5 (artificially aged only)	typical	15000	0.0043
	T4 (solution heat treated)	typical	11000	0.0037
	T6 (solution heat treated	typical	19000	0.0049
	and artificially aged)	minimum	16000	0.0045
AZ91C—	F (as cast)	typical	11000	0.0037
	T4 (solution heat treated)	typical	11000	0.0037
	T6 (solution heat treated	typical	19000	0.0049
	and artificially aged)	minimum	16000	0.0045
AZ92A—	F (as cast)	typical	14000	0.0042
	T5 (artificially aged only)	typical	17000	0.0046
	T4 (solution heat treated)	typical	14000	0.0042
	T6 (solution heat treated	typical	20000	0.0051
	and artificially aged)	minimum	18000	0.0048
M1B—	F (as cast)	typical	4000	0.0026

Additional copies of this specification may be obtained from the American Society for Testing Materials, 1916 Race St., Philadelphia 3, for a nominal sum.

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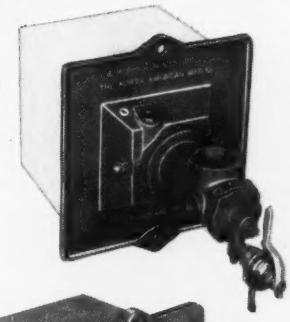

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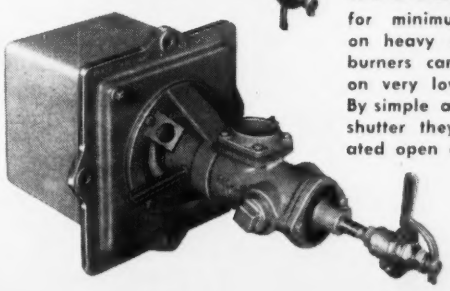

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MAN-TO-MAN

on the Molder's Bench

"The Foundry Bias"

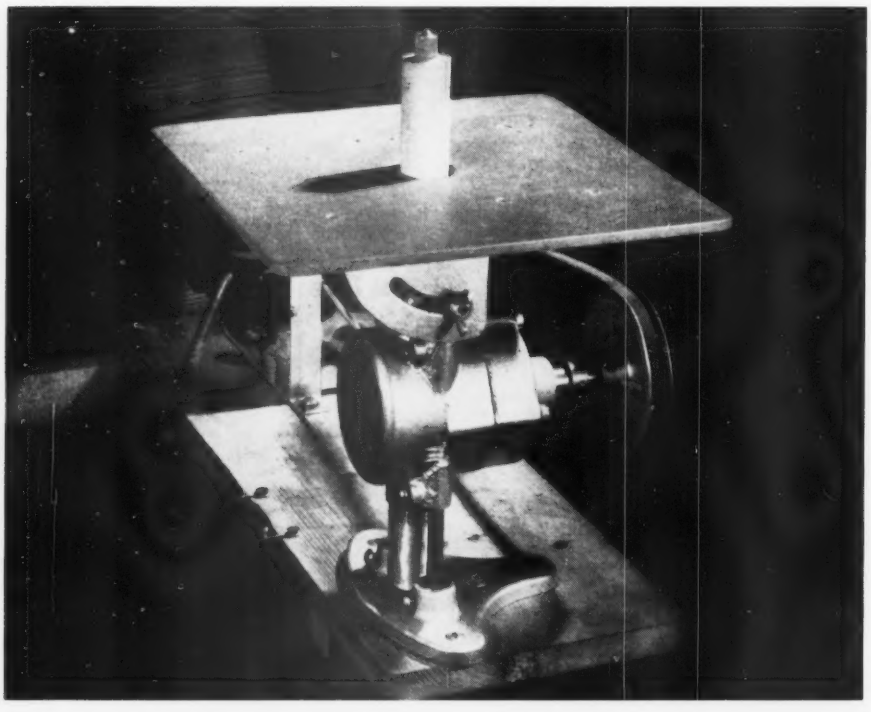
By RALPH L. LEE

IT's BEEN pretty much nip and tuck here lately trying to pry off a little time for the Lee Hobby Foundry from my tightly packed travel schedule. Sometimes I wonder how I do it at all, but I do manage to get out of my store clothes, into the blue jeans, checkered shirt, molder's shoes and slip on up to the foundry after each trip.

A keen interest bordering on a mania is the magnet that attracts the little crumbs and fragments of loose time that usually go to waste.

Visions of a small bench spindle sander had been haunting me, even while on my trips. In fact, the backs of envelopes were filled with sketches of various brain-storms. I wouldn't be stretching it a bit in saying that over a dozen different ideas ambled through the old bean before one hit the jackpot. Isn't it funny how you know or rather feel the instant when you can honestly say—that does it?

I couldn't help but think that if the Lee Hobby Foundry and Pattern Shop had been a welding shop, the spindle sander would have been an entirely different animal than it was. If sheet metal was the specialty the sander would have been another breed of cats. Woodwork would have produced still another goldberg. What I'm trying to say is that if we handed the self-same idea to three different designers, each would build it along the lines of the work he was most familiar with.



With molder's blood in my veins, the Lee Hobby Foundry at hand and my drawing board in front of me the design of my sander took form at every stage with the do's, the don'ts and the can'ts of foundry practice in mind. Designing anything is one continuous chain of choices, some vital but most made on the basis of personal preference

I only wanted to build one sander for myself—and, if it turned out all right, another for my son Ralph (who by the way is a cabinet maker). Then, I got to thinking, should it turn out better than I expected I might want to make maybe a dozen or more for Christmas presents or something.

In any event, I designed the sander with small production in mind, a minimum of machining and a maximum of *just as-cast* parts. Now all of this isn't just day dreaming, for the sander is finished and making saw dust. (That's a photo of it here on the page.)

Only two machine tools were used —the lathe and the drill press. A round head screw cast as an insert took the place of an expensive wing screw or knurled-head. What would have been a stamping for the adjustment of the table turned out to be a casting—also the clamp that works with it. The crank could have been a forging or milled out of bar stock but it took the sand route.

Holes to be drilled were spotted on the pattern; and by the way, I'll betcha a lot of drill jigs could be tossed into the ashcan if we really went to town making molds and patterns on the drafting board. Maybe I did lean over backward in favor of the foundry without going to ridiculous extremes, but I'm convinced we haven't scratched the surface when it comes to giving the foundry full rein.

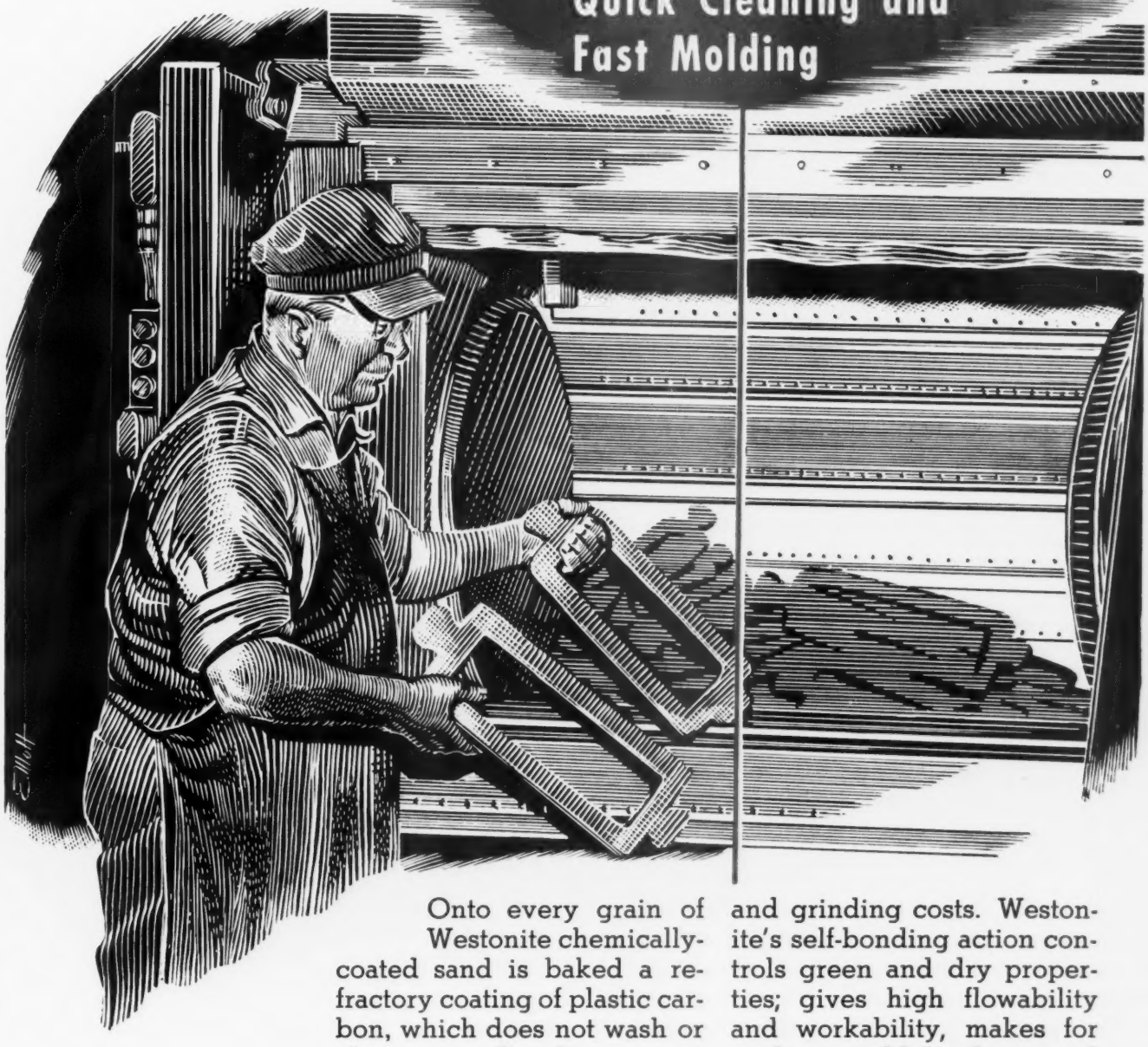
I'll admit I'm doing a bit of bragging, but the real reason for telling you about the spindle sander episode is an excuse for reminding us again of the need for getting under the hide of folks who design the stuff for which we make castings.

While having a crack at a stack of prints before the patterns are made is a darned fine thing, it's a little late to take full advantage of all the foundry art has to offer. Maybe it is asking too much, but if we can innoculate designers to a point where they will be haunted with casting possibilities from the first rough sketch to the finished production prints we'll uncork one whale of a lot of foundry business.

FOUNDRYMEN!

"Go Westonite"

for Smooth Casting Surface, Quick Cleaning and Fast Molding



Onto every grain of Westonite chemically-coated sand is baked a refractory coating of plastic carbon, which does not wash or chip away. Result: no more burn-in, cleaner and smoother castings, lower cleaning and grinding costs. Westonite's self-bonding action controls green and dry properties; gives high flowability and workability, makes for uniform mold hardness and exact pattern reproduction; speeds up molding.

Write for factual literature

EASTERN CLAY PRODUCTS
DEPARTMENT
International Minerals & Chemical Corporation — 20 NORTH WACKER DRIVE, CHICAGO 6

E C P Since 1926

QUALITY, SERVICE, DEPENDABILITY, PROGRESS

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DIXIE BOND • BLACK HILLS BENTONITE • REVIVO BOND • REVIVO CORE PASTE
BALANCED REVIVO • BONDACTOR • CUPOLINE • DURA PRODUCTS • WESTONITE

Casting Brake Drums

(*Concluded from page* 122)

a gate in the chute closes, the conveyor starts, and moves until an empty bucket reaches the loading position. Then the conveyor stops, the bucket turns over and rests on the scale platform, and the gate in the chute reopens. As each bucket arrives at the delivery point in the scrap yard, it is automatically turned over to dump its contents in an orderly pile.

The 70 x 200 ft yard at the north end of the building is spanned by a 10-ton crane, and served by a spur track elevated 15 ft above ground level. Pig iron and scrap are unloaded by magnet. Limestone and coke are elevated by belt conveyor to 28 x 28 ft bin, which holds 68 tons of coke and 87 tons of stone. From a 20 x 20 loading platform (Fig. 8) with the usual weigh hoppers, two drop-bottom cupola charging buckets are filled with iron and scrap. These are 48 in. in diameter, will hold a 3500-lb charge, and are set on a 9 x 15 ft transfer car, (Fig. 9). Coke and stone are loaded into the buckets through weigh hoppers, and the car is then moved to a position under the hoist space, which is spanned by a charging crane of special type, designed by Budd engineers. This crane is mounted on a circular track 28 ft in diameter over the hoist space, and can be revolved from the charging floor by a hand chain, so as to feed either cupola, or unload material on the floor. The charging buckets are run into the cupola, lowered onto a "wish-bone," and their contents dumped evenly over the preceding charges. The standard charge at present is 2000 lb.

Adjust Melting Speed

Metal is melted in two No. 9½ cupolas, 75 ft high, and with 90-in. diameter shells, which are used on alternate days. At present they are lined down to 48-in. diameter, and melt approximately 5 tons per hour. Each casting weighs about 15 lb and the sprue 5 lb. With a production of 520 castings per hour, therefore, a little over 5 tons of metal per hour is required to feed the system.

A multi-stage centrifugal blower of ample size to allow greatly increased melting capacity furnishes the air, and the supply is governed by an air-weight control device. At present 4000 cfm of air at 16 oz pressure is used. The cupolas are designed to permit the use of hot blast when a larger output is required. When lined to 60 in. they will each melt 10 tons per hour without, and 15 tons with, hot blast. Lined to 72 in. diameter, with hot blast, they will turn out 20 tons per hour each. The cupolas have spark and dust arresters, which use 300 gallons of water per minute, and remove 98 per cent of the dust from the products of combustion. The dirty water is piped to the same pit as that from the other dust collectors and the water is recirculated.

At each side of the charging doors, gas burners are provided to ensure that the CO in the cupola gases is ignited early and continuously. The slag taps run steadily into a stream of water in troughs leading to the settling tank in the yard, the water being recirculated. Slag and dust settled out in the tank are removed at intervals with a grab bucket. Deflectors over the slag taps can be swung into place to keep the slag wool occasionally produced from floating about. The cupolas are lined with a quarried stone, and are patched with a refractory gun.

"Just one more Indian, Ed. . . "

The castings are cleaned in one or the other of two 9-ft diameter six-spindle airless blast table machines using a malleable type shot. Two men take the castings off the conveyor and set them on the revolving spindles of the machines, each of which holds two or 3 castings. When the main table has completed a revolution, the castings are turned over and set through a second time to clean the reverse side. They are then set on a roller conveyor, where one man inspects, one chips any rough places, and one grinds down small sand holes or similar defects on the outer surfaces of the castings. A dust collector outside the building serves the blast machines. Though the standard of inspection is very rigid, the rejected castings have so far averaged not over 1½ per cent of the total number produced.

Shipping is by truck, the dock being provided with a 4 x 4 ft. platform scale of 5000 lb capacity.

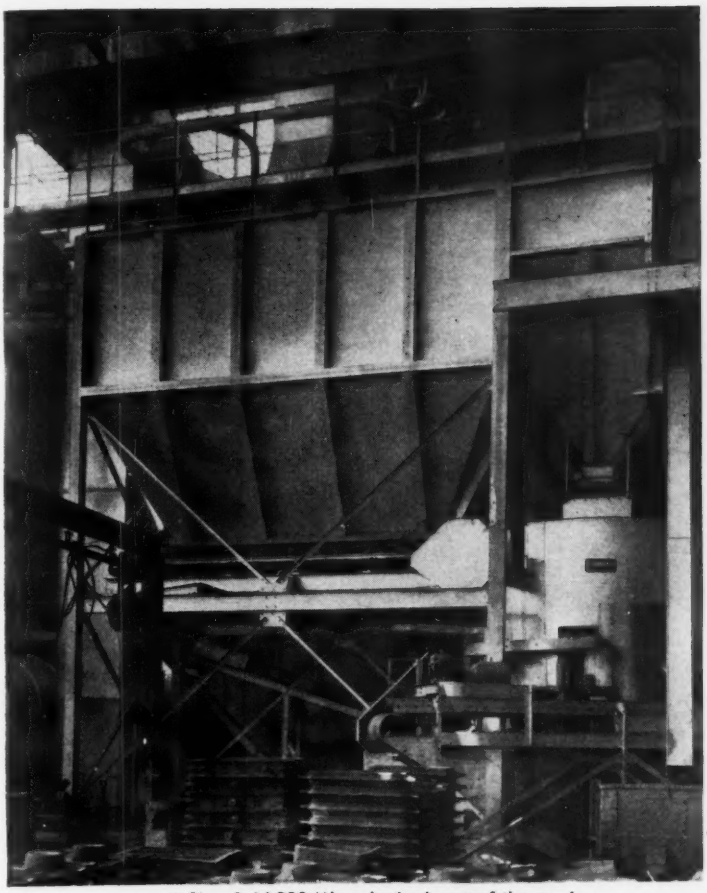
One of the features that immediately arrests the attention of a visitor to the plant, is the complete absence of dust and smoke in the air in all departments. As the foregoing description readily shows the excellent system of ventilation and dust exhaust is responsible for this desirable condition. The air withdrawn from the foundry totals 131,000 cfm. This is made up of 33,000 cfm at the pouring zone, 48,000 cfm at the smoke hood, 10,000 cfm at the cupola spouts, 3000 cfm at the sand bins and 37,000 cfm at the shakeout and return sand belts. To balance the exhaust 142,000 cfm is introduced into the building including 24,000 cfm at the pouring zone, 30,000 cfm at the smoke hood and 88,000 cfm at ventilator ducts. There is therefore a slight positive air pressure in the plant. The air in the main foundry building is changed 15 times per hour, and that in the shakeout room 66 times per hour.

Shop Amply Ventilated

For summer ventilation, long windows are provided which are suspended at the top and can be opened at the bottom to an angle of 45 degrees as shown in Fig. 10. At the ends of the long sections of sash are located stationary sashes, constructed in such a manner that the windows can be kept open during a severe storm. The building is provided with a 2¾-in. thick poured gypsum roof, which has a high insulation value in both summer and winter. The main structure is of steel, concrete and brick, and glass comprises 38 per cent of the outside wall area. At the south end of the main building, separated from the foundry by a corridor, are the office, locker rooms and wash rooms, which are of the most modern type.

Editor's Note: Manufacturers of equipment mentioned in this description of the Budd Co. foundry include: Detrex Corp., Detroit; Pangborn Corp., Hagerstown, Md.; Dings Magnetic Separator Co., Milwaukee; National Engineering Co., Chicago; Modern Equipment Co., Port Washington, Wis.; Osborn Mfg. Co., Cleveland; Foundry Equipment Co., Cleveland; Claude B. Schneible Co., Detroit; Simplicity Engineering Co., Durand, Mich.; Barber-Green Co., Aurora, Ill.; Whiting Corp., Harvey, Ill.; Spencer Turbine Co., Hartford, Conn.; Foxboro Co., Foxboro, Mass.; Eastern Clay Products Dept., International Minerals & Chemical Corp., Chicago; Jeffrey Mfg. Co., Columbus, O.; Link-Belt Co., Chicago.

Figs. 3 and 6 courtesy of Link-Belt Co. Fig. 7 courtesy of Pangborn Corp.



A Clearfield 930 Mixer is the heart of the sand conditioning system in a gray iron foundry.

wherever foundry sand is used . . . .

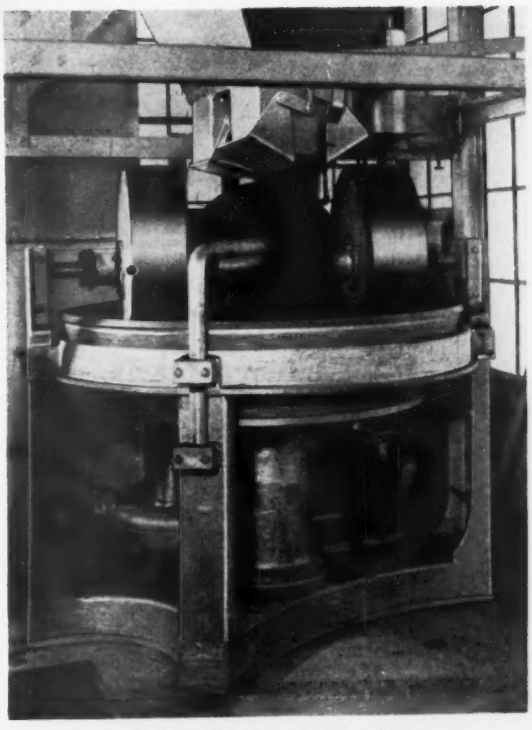
the

Clearfield Mixer *is needed*

A consistent and adequate supply of good foundry sand is indispensable to the efficient production of high quality castings—and that's the kind of sand supply the Clearfield Mixer turns out all the time. With a Clearfield you can assure yourself of the amount of sand you need, when you need it, where you need it and with the qualities you require.

Clearfield Mixers are available in a range of sizes to meet any requirement. As individual units or as part of an integrated sand processing system, Clearfield Mixers provide dependable, efficient and economical performance.

Write today for Catalog No. 79 for information.



A Clearfield Mixer in a modern brass foundry.

CLEARFIELD MIXER

MIXES, TEMPERS AERATES

CLEARFIELD MACHINE COMPANY

CLEARFIELD PENNSYLVANIA, U. S. A

Herman

Dominion Foundries & Steel, Limited, Hamilton, Ontario

THIS PLANT, started in 1912, is one of the largest steel foundries in Canada. Total plant area is in excess of 40 acres. Total employment is 2500, with approximately 1000 working in the foundry and melting divisions.

Dofasco's foundry has a capacity of 3000 tons of railroad castings per month, typical work being side frames, bolsters, driving wheels, etc.

It is a good place to work because its equipment is modern in every respect. Particular emphasis is placed on sand handling procedure and conveying apparatus.

Also, Dominion has an exceptional labor relations record. Profit sharing, inaugurated in 1937, is now worth $7,500,000.

The Herman 10,000 pound machine illustrated is one of several used by Dofasco to help maintain its reputation as a good place to work.

Efficient, fast, on-schedule production is a natural result.

Herman machines used in this plant, and elsewhere throughout the world, are simple to operate, one valve assuring fast, steady hydraulic action for rollover and pattern draw; no power required for rollback operation; extremely long pattern draw distance.

Herman Molding Machines have made their way by the way they're made.

Herman **MOLDING MACHINES**

HERMAN PNEUMATIC MACHINE CO., UNION BANK BUILDING, PITTSBURGH 22, PA.

This ad reproduced herewith originally appeared in the October, 1950 issue of FOUNDRY.

MOLDING MACHINES

help make this foundry a good place to work, *because*

as Mr. J. A. Koeppe, Foundry Superintendent, Dominion Foundries and Steel, Limited, expresses it: "Dominion Foundries and Steel has found that Herman Molding Machines are dependable in the economic production of accurate molds for a variety of steel castings.

Our first Herman Machine was installed in September, 1918. Since then we have purchased several others and each, as a result of progressive improvements and simplicity of control, has helped us to increase production until today the present machines (installed in 1943) are producing 2,000 tons of high quality castings per month with a minimum of delays, and at reasonable maintenance cost."

You don't *have* to take our word for it. You have the word of men like Mr. Koeppe and thousands of others who have used Herman Machines over the years and have found them consistently dependable.

The surest way, of course, is to prove for yourself, that Herman Molding Machines *have made their way by the way they're made.*

Herman **MOLDING MACHINES**

HERMAN PNEUMATIC MACHINE CO., UNION BANK BUILDING, PITTSBURGH 22, PA.

OBITUARY

RUSSELL HUNT, 71 former vice president, Sloss-Sheffield Steel & Iron Co., Birmingham, died Apr. 17, at his home in Daytona Beach, Fla. Mr. Hunt, a native of Ripley, Miss., joined the company in 1898 in a secretarial capacity to the president of the company, later becoming cash-

RUSSELL HUNT

ier, secretary-treasurer, southern sales manager, sales manager and vice president in charge of sales, the office he held when he retired in 1946. During World War II he set up the pig iron allocation program in Washington which was instrumental in allocating that material to avoid shortages. Upon his retirement he was honored by friends in the steel industry for advancement in the steel and iron industries through the country. He received wide acclaim for his editorship of "Pig Iron Rough Notes," a publication devoted to problems of foundrymen and pig iron users.

* * *

Abraham J. Bloom, 69, president, Standard Brass Foundry Co., Cleveland, died May 11. Mr. Bloom, a native of Hungary, was brought to Cleveland at an early age and attended public schools there, graduating from the former Baldwin-Wallace College night school. He joined Standard Brass as a clerk in 1906, leaving the company for a short period after being admitted to the Ohio bar in 1907. For the past 22 years he served as president-treasurer of the company.

* * *

C. Laurence Warwick, 62, who since 1919 had been chief executive officer of the American Society for Testing Materials, died unexpectedly Apr. 23. Mr. Warwick had been active in the society since 1909 when he graduated from University of Pennsylvania. While an instructor and assistant professor at the university he also served as assistant secretary of ASTM with Edgar Marburg, the society's founder secretary. Upon Mr. Marburg's death Mr. Warwick was appointed secretary-treasurer, and in 1946 became executive secretary. During World War II he was head of the specifications branch of the Conservation Division, WPB, and later headed the Materials Division which resulted in savings of critical and strategic war materials through issuance of emergency standards.

* * *

James H. Bernard, resident manager of the Foundry Division Eaton Mfg. Co., Vassar, Mich., died May 9. Mr. Bernard was graduated from University of Michigan in 1923 and spent his entire business career in the foundry industry.

* * *

William B. Ziegelmueller, 47, president, Electric Steel Castings Co., Indianapolis, died unexpectedly Apr. 4, in Covington, Tenn. Mr. Ziegelmueller, a native of Indianapolis, attended night school there and joined Electric Steel as a truck driver in 1924. Two years later he was transferred to foundry work as a molder, later becoming foreman in the molding department. In 1939, he was made

WILLIAM B. ZIEGELMUELLER

plant superintendent in charge of the entire foundry. He was elected vice president and a director in 1942 and three years later became vice president-general manager. He had been president since 1950. Mr Ziegelmueller was active in affairs of the American Foundrymen's Society and in 1947-48 was chairman of the Central Indiana Chapter.

* * *

Mollie C. Wiechert, 66, secretary and part owner of the St. Clair Foundry Corp., Centralia, Ill., died Apr. 22. Miss Wiechert had been a resident of Centralia since 1926 when the foundry moved from Belleville, Ill.

* * *

Fred C. Hansen, 62, superintendent, Brewster Co., Shreveport, La., died there Apr. 12. A native of New Orleans, Mr. Hansen had been associated with the Brewster foundry since 1923.

* * *

Vander M. Doebus, 49, president, Tractomotive Corp., Deerfield, Ill. died Apr. 8 in Chicago. From 1928 to 1945 Mr. Doebus was associated with Allis-Chalmers Mfg. Co., Milwaukee.

* * *

Charles F. Vesely, 53, safety manager, Howard Foundry Co., Chicago, died Apr. 3 in that city. He had been associated with the company five years.

Trains Customers' Men In Machine Operation

DoAll Co., 254 North Laurel Ave., Des Plaines Ill., has provided new and larger school quarters for training its sales service engineers and customers' employees in the operation, maintenance and application of band machines, precision surface grinders, and precision measuring instruments. At the factory, trainees are instructed in assembly and alignment procedures for band machines, welders and precision surface grinders. School sessions provide practical experience in operation and application of company machine and measuring devices.

Book Review

North American Combustion Handbook, cloth, 322 pages, 6 x 9 in., published by North American Mfg. Co., Cleveland 5. Price $2.

Carrying the subtitle of "A Basic Reference on the Art and Science of Industrial Heating with Gaseous and Liquid Fuels," this handbook is intended to provide a basic explanation of the theory of combustion. Included are outlines for combustion, heat transfer, and fluid flow calculations; charts and data to simplify and speed these calculations, and a discussion of combustion equipment, its selection and operation.

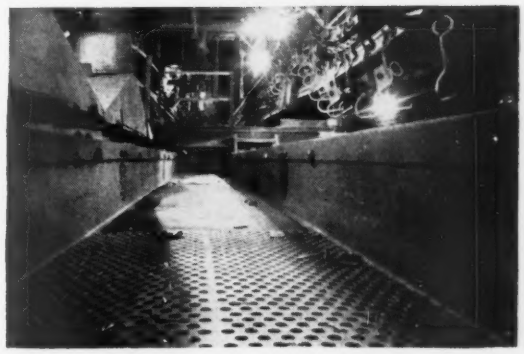
Although the book deals mainly with industrial heating with gaseous and liquid fuels, it also contains considerable information applicable to commercial heating and to solid fuels.

HEWITT-ROBINS

FOR TOUGH MATERIALS HANDLING JOBS

Hewitt-Robins Vibrating-Conveyor

Handles Anything a Belt Conveyor Can't



Faster: The Vibrating Conveyor moves a full pan load of material . . . hot or cold, wet or dry, lump or pulverized . . . quickly, quietly . . . on the horizontal—downhill—uphill to 10°.

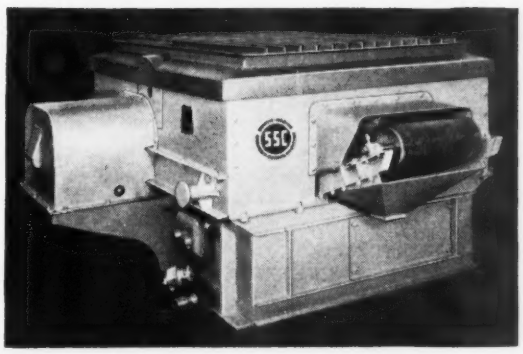
More Efficient: Won't bog down even when loaded to the top of the pan—takes multiple feeds—starts under full load—has feeder action—spreads surges.

Easier To Install—Maintain: The Vibrating Conveyor requires no heavy foundation because vibration in the base structure is kept to a minimum—needs lubrication at only 4 points.

For complete facts, write for Bulletin No. 135.

FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION INC. MEMBER FEMA

DESIGNED FOR FOUNDRY SAVINGS



Hewitt-Robins SSC® Unit

5 Foundry Operations with 1 Piece of Equipment

Saves Time: This one compact, self-contained unit takes care of your entire shakeout and sand removal in a single operation.

Saves Space: Requires no more space than the average-size shakeout, yet it serves 5 complete foundry functions . . . flask shakeout—sand screening—lump breaking—conveyor feeding—tramp-metal trapping!

Saves Money: In one jobbing foundry, where it normally took 8 men a total of 7 hours to completely shakeout molds and reclaim sand, the entire foundry floor was cleaned up in just 3 hours by only 3 men and an SSC Unit.

Saves Trouble: Entirely automatic . . . The Hewitt-Robins SSC Unit needs no attention . . . just put the flask on the shakeout deck—turn on the power and the material flows smoothly from sequence to sequence until the Feeder Belt Conveyor discharges the sand.

For complete details, write for Bulletin No. 136

HEWITT-ROBINS INCORPORATED
STAMFORD, CONNECTICUT

Hewitt Rubber Division · Robins Conveyors Division · Robins Engineers Division · Hewitt Restfoam® Division

Industry BRIEFS

CAPITOL Foundry Co., Phoenix, Ariz., has acquired a tract of land near Phoenix on which it will construct a $1,600,000 foundry of 25,000 ton annual capacity for production of cast steel grinding balls. Plans also are under way for constructing a $1,500,000 general foundry on the same property. Capitol recently was purchased by National Malleable & Steel Castings Co., Cleveland.

* * *

United Boiler, Heating & Foundry Co., Hammond, Ind., now is the exclusive manufacturer of Hensel Green & Co. industrial tractors, according to D. N. Nau, assistant to the president at United.

* * *

Steiner-Ives Co., Newark, N. J., manufacturer of industrial ovens, has appointed Harry Bliven, 144 Crystal St., Newton Center, Mass., as New England representative.

* * *

American Refractories & Crucible Corp., North Haven, Conn., has appointed Christy Firebrick Co., St. Louis, sales distributor of its complete line of products in Oklahoma, Missouri, Texas, Louisiana, and Arkansas.

* * *

Hewitt-Robins Inc., Stamford, Conn., manufacturer of conveying and vibrating machines and industrial rubber products, has opened a new office in the Porter Bldg., 406 West 34th St., Kansas City, Mo. Robert E. Crane is in charge of the new office.

* * *

International Abrasive Corp., has moved its office from 500 Fifth Ave., New York 18, to 41 Green St., Paterson 3, N. J. where its plant is located.

* * *

Chicago Pneumatic Tool Co., Franklin, Pa., has contracted with Meehanite Metal Corp., New Rochelle, N. Y., to produce Meehanite castings.

* * *

Mid-West Abrasive Co., Owosso, Mich., has acquired Abrasive & Supply Co., Los Angeles, to be operated as a direct factory branch and warehouse, enabling the company to offer service to its West coast customers. Glenn E. Winton, formerly of Owosso, Mich., has been appointed West coast manager.

* * *

Keyco Equipment Corp. has been incorporated at Kings, N. Y., to operate a foundry and machine shop business. Directors are Alfred Reale, 136 Clayton Rd., Scarsdale, N. Y.; Ann Newborn, 215 West 75th St., and Viola Friedman, 170 West 74th St., New York.

* * *

Burnet Scrap Corp. has been incorporated at Syracuse, N. Y., to conduct a general machine shop and foundry supplies business. Directors are Rivie K. and Gabriel M. Goldsmith, 608 Crawford Ave., and Vivian Kronenberg, 137 Didama St., Syracuse.

* * *

Meili-Blumberg Corp., New Holstein, Wis., has acquired from Frank G. Hough Co., Libertyville, Ill., its line of tractor sweepers and will distribute as well as continue manufacture of the sweepers under the M-B trademark.

* * *

Continental Foundry & Machine Co., Wheeling, W. Va., plans construction of an addition to its heat treating building and erection of a new gas house for storage purposes. Total cost is about $124,000.

* * *

Simplicity Engineering Co., Durand, Mich., has completed a new 80 x 220-ft addition. New space will be used for added machine shop facilities.

* * *

Sollberger Engineering Co., 510 Hazlewood St., Marshall, Tex., manufacturer of low alloy steel castings, held a public open house Apr. 1.

* * *

Tennala Foundry Co. is constructing pipe manufacturing facilities on Tennessee Products & Chemical Corp. properties in Rockwood, Tenn.

* * *

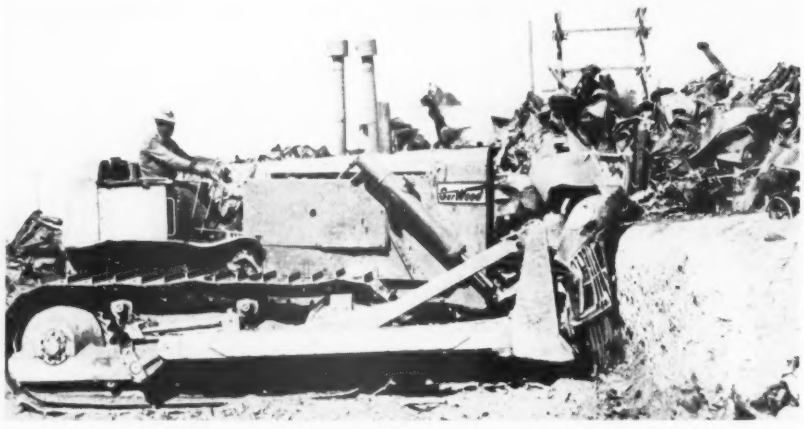
Newnam Foundry Co., South Main St., Kendallville, Ind., suffered fire damage Apr. 14 estimated at several hundred thousand dollars.

* * *

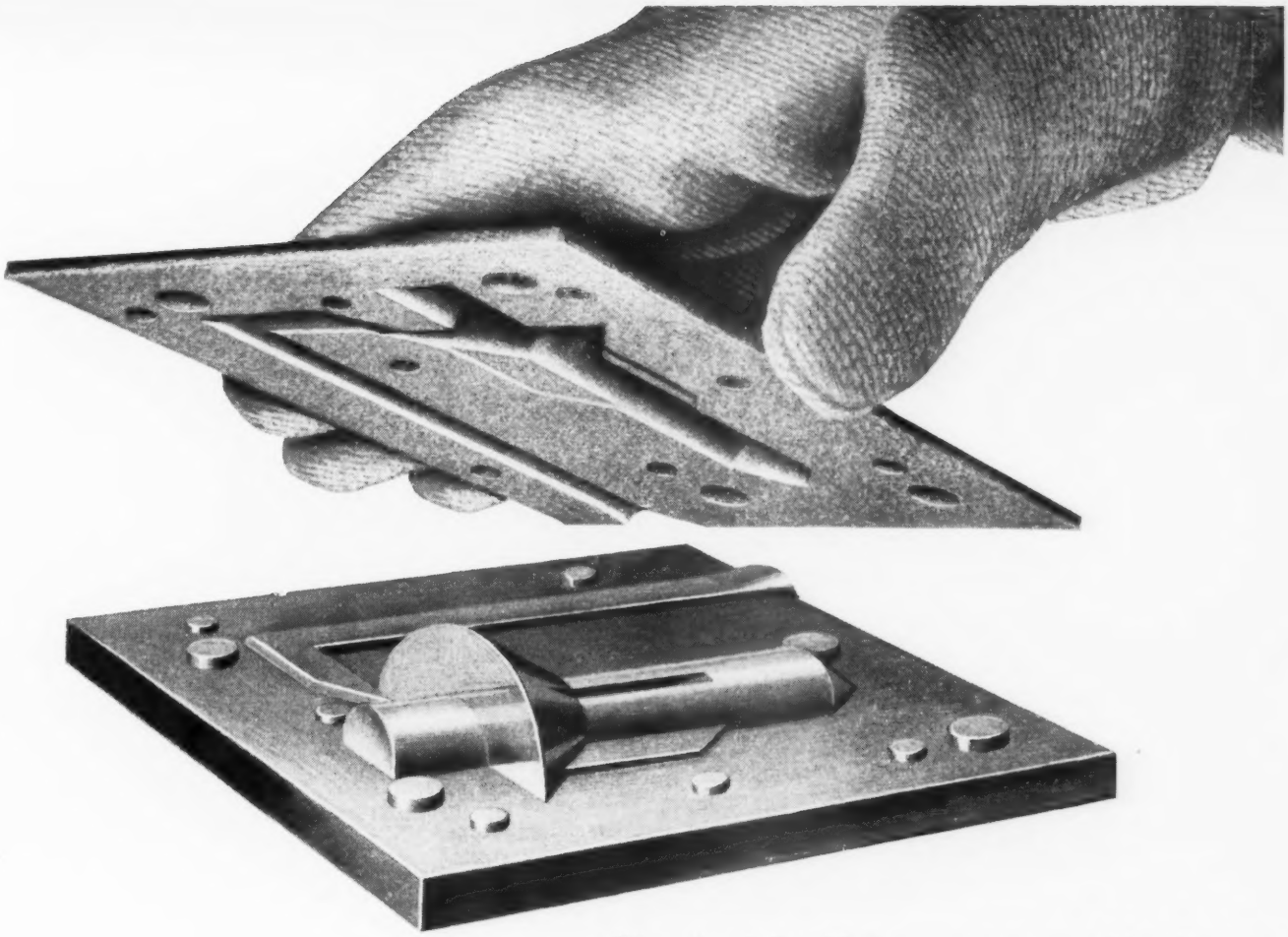
Commercial Iron Works Inc., 2021 S. E. Grand Ave., Portland 14, Oreg., suffered an estimated $85,000 fire loss Apr. 22.

* * *

Ferro-Cast Corp., Zeeland, Mich., has been incorporated as a centrifugal and permanent mold foundry. Operations are expected to begin in July.



SCRAPPER: Compressed Steel Co., Denver, uses an Allis-Chalmers tractor with a Gar Wood hydraulic mounted dozer blade to compress old auto bodies, including frames, against a concrete bunker. The tractor then pushed the "pancake" to a crane which feeds the scrap baler. Tractor and dozer attachment are said to crush 75 car bodies a day



When *this* shell is lifted, everyone concerned benefits—you, your employees and your customers—thanks to the tremendous advantages offered by the revolutionary new shell-molding process!

HERE'S A "SHELL GAME" *where EVERYBODY wins...*

The new shell process, which requires only 5% the sand needed in conventional green sand molding, yields more castings per ton of metal . . . makes possible close tolerances that completely eliminate costly machining in many cases . . . offers other important advantages that add up to big savings for you in time, money and materials.

General Electric's new phenolic shell resin is specially designed to help you get the maximum benefits that this process offers. It forms strong, dimensionally accurate shells that produce clean castings with close tolerances.

For more information about shell molding and G.E.'s new shell resin, just mail the coupon.

SEND COUPON TODAY FOR MORE DETAILS

General Electric Company
Section 126-3A, Chemical Division
Pittsfield, Massachusetts

Please send me a free copy of "G-E Phenolic Resins for Shell Molding Process." Include information on:

- ☐ G-E Phenolic Resin Core Binder 12353
- ☐ G-E Permafil 3255 for impregnating porous castings

Name_____

Firm_____

Street_____

City_____ Zone_____ State_____

You can put your confidence in—

GENERAL ELECTRIC

126-3

By EDWIN BREMER

Foundry DEVELOPMENTS

SOUTHERN cast iron pipe foundry employs an extremely simple method to apply its name and trademark on the finished pipe. Instead of the common procedure of using a brush and stencil, a flat rubber stamp incorporating the lettering and emblem is located on the rack down which the pipe roll after inspection. Aluminum paint is applied occasionally to the stamp and is transferred automatically to the pipe as the latter roll over the stamp.

* * *

LATEST British development is a device for reclaiming metal from cast iron borings and turnings by injecting them in the loose form into the cupola just above the melting zone. Chute from charging floor conducts borings to the desired point where they are forced into the cupola through an opening in the shell and lining by a pneumatic ram. Apparatus can be adjusted to handle quantities from 5 to 25 per cent of the weight of the metal charge. Losses using borings are claimed to be no greater than experienced with an all-metal charge.

* * *

STUDY of porcelain enameling at National Bureau of Standards indicates that cobalt oxide in the ground coat forms a metallic cobalt layer at the enamel-metal interface which may account for its action in promoting adherence of enamel to iron. Work was conducted by W. N. Harrison, J. C. Richmond and associates, and radioactive cobalt was used as a tracer in the frit or glass used in the coating. Experiments performed so far do not indicate whether the cobalt deposit is pure or an alloy with nickel, iron or both, but do show that while concentrated at the interface, it did not penetrate the iron.

* * *

BRITISH foundry investigating recovery of iron from machine shop turnings and borings melted directly in the cupola at the end of the day's heat found it necessary to reduce the amount of blast to one-third that used for melting iron. Procedure is to charge some cast iron scrap first and then put in the borings a few shovelfuls at a time to prevent chilling. Recovery is about 85 per cent. Mixing borings with cement to form briquets also was tried, but even though cupola loss was decreased considerably, the total overall cost was about 30 per cent higher.

* * *

NATIONAL Bureau of Standards reports development of a rapid photometric method for determining copper in plain carbon and alloy steels. Work is by J. L. Hague, E. D. Brown and H. A. Bright. Method involves formation of a copper diethyldithiocarbamate complex in butyl acetate which is measured in a colorimeter at 560 to 600 mu. A single determination is said to be made in about 30 minutes while a set of eight can be completed in 2 hr. Nickel content of the sample does not interfere in the analysis. Accuracy is of the order of 0.001 per cent Cu for samples containing less than 0.05 per cent, and average values for samples containing from 0.05 to 0.25 per cent Cu were within 0.005 per cent of the certified value.

* * *

ARTICLE on "Core Extraction Forces Required in Pressure Die Casting" by W. M. Halliday in the March issue of *Metallurgia* suggests an extremely useful and simple formula which can be applied during the preliminary development of die design, and which is said to give reliable results. It is: $P=8$ DLVS, where P is the axial force required to overcome the radial gripping pressure, i.e. the ejection force. D is the core diameter. L is the length of the core projecting into the casting wall. S is the average thickness of the wall section immediately around the cored hole, and V is a variable factor having the following estimated values for the different die casting alloys: Aluminum 15; zinc-base 22; Copper-base 25. To take cognizance of several other variable factors the author advises employment of a suitable safety factor such as increasing the calculated value of P for zinc-base alloys by 20 to 25 per cent, and for the high melting point alloys by 25 to 35 per cent.

* * *

TESTS to date, according to Alloy Casting Institute, Mineola, N. Y., indicate that the HF alloy containing 21 per cent Cr and 9 per cent Ni appears to be the material most likely to provide the combination of strength and corrosion resistance required for intermediate temperature service between 900 and 1400° F. Investigation is being conducted at Battelle Memorial Institute under the supervision of J. H. Jackson on a series of 14 compositions in the range mentioned to determine those offering optimum mechanical properties at elevated temperatures. If present research continues favorable, considerable nickel will be freed for the higher temperature applications.

* * *

ONE TYPE of apparatus used to determine mass concentration of dusts uses filter pads of naphthalene for the collector. However, due to high volatility the pads tend to disintegrate when large volumes of air are sampled. Investigation in Great Britain, and reported by P. F. Holt in the March issue of *Metallurgia,* shows that dimethylterephthalate runs for long periods without any disintegration. The material is a white crystalline solid, chemically inert under normal conditions, with a melting point of 141° C. It sublimes rapidly under reduced pressure considerably below its melting point—for example, at 105 to 110° C. Dimethylterephthalate is insoluble in water, non-hygroscopic and unaffected by moist atmospheres.

* * *

SOME FOUNDRIES in Great Britain and on the Continent are using what is termed "under-sand frame" molding which is claimed to obviate the slowness and irregular ramming of jolting or the necessity of ramming deep holes twice in squeezing. In this method a sand frame is placed beneath the flask on a squeeze machine. The sand frame is slightly larger than the flask, and when the pressure is applied to the lower platen, the pattern is forced up against the sand. Top platen or squeezer head covers full size of flask exterior. Height or depth of the sand frame as well as the stroke of the platen is adjustable. It is said that with this method mold face can be obtained with any desired hardness.

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Activities of Foundry

GROUPS

Chicago

SPECIAL guests at the April 7 meeting of Chicago Chapter, AFS, included the Austrian Foundry Productivity Team of 14, visiting United States foundries under auspices of Mutual Security Administration. The delegation leader was Max Kraus, owner and chief engineer, Kolben-Kraus, Vienna.

Reporting for the nominating committee—consisting of Past Chairman C. V. Nass, vice president, Pettibone-Mulliken Corp.; W. D. McMillan, metallurgical supervisor, International Harvester Co.; and Fred B. Skeates, general superintendent, Link-Belt Co.—Chairman Nass presented the following nominations for 1952-53:

For chairman, John H. Owen, Chicago district sales manager, Harbison-Walker Refractories Co., who is vice chairman for 1951-52. For vice chairman, John A. Rassenfoss, research metallurgist, American Steel Foundries. For secretary to succeed himself, Robert L. Doelman, sales engineer, Miller & Co. For directors, Fred L. Riddell, plant metallurgist, H. Kramer & Co.; Robert P. Schauss, Chicago sales manager, Werner G. Smith Co.; and B. C. Yearley, assistant manager, National Malleable & Steel Castings Co.

Roy W. Schroeder, assistant professor, foundry and pattern laboratory, Navy Pier Branch, University of Illinois, and chairman of the Chapter's educational committee, reported on the most successful "Melting School" conducted in March. Enrollments totaled 510, with attendance at sessions as follows: Steel—525; Gray Iron—325; Malleable—250; and Nonferrous—175. Approximately 100 attended four or more sessions and will be awarded certificates.

Chapter Vice Chairman Owen introduced Warner B. Bishop, Archer-Daniels-Midland Co., Cleveland technical speaker, who also presented the company's film, "The ADM of Cores." —*Erle F. Ross.*

Central Indiana

AT THE Apr. 7 meeting of Central Indiana Chapter of AFS Hyman Bornstein, chief technical consultant of Deere & Co., Moline, Ill., was the principal speaker. Mr. Bornstein first reviewed metallurgical conditions during World War I, explaining how the tensile strength of cast iron was around 28,000 psi, high-strength irons having tensiles of around 35,000. Now tensiles run around 65,000 to 85,000 psi, brought about through more efficient use of alloys. Also, the use of mixing ladles has played an important part in obtaining uniform high-strength irons.

The speaker stated there had been some over-selling of high-strength iron, and related some experiences during World War II. Many design engineers thought that if 35,000 psi iron was good, 65,000 psi was better, so they specified that quality. In the interest of alloy conservation, an educational program was started. This seems to have done the job. In addition, Mr. Bornstein outlined some of the uses and advantages of nodular iron. In his opinion it will never replace malleable iron, and he closed by saying that the advancements made in ferrous metallurgy in the past 30 years are only the beginning of what will be made in the next 30 years.—*Paul V. Faulk, Electric Steel Casting Co.*

Pittsburgh

APPROXIMATELY 115 Pittsburgh district foundrymen and their guests attended the March meeting of the association at the Fort Pitt Hotel. Herman L. Smith, executive technical engineer of American Smelting & Refining Company's Federated Metals Division, was the speaker.

He stated that the coal miner, an automobile engine and a production foundry have a common problem. As fuel is burned, explosion takes place. The miner does not fear an explosion, but he does fear what is known as the afterdamp, a moist, gas-filled product of the explosion. Unless the miner is rescued or gets away from this afterdamp quickly, he suffocates and dies. The same applies to melting metal in the foundry. If the metal is allowed to remain in contact with improperly controlled products of combustion, it becomes gassed and subsequently unusable.

Mr. Smith said that if we could instill the fear of a miner and the knowledge of the automobile engineer in the production foundry, many nonferrous foundry problems would be eliminated because one of the com-

(*Continued on page* 206)

CENTRAL INDIANA Chapter of the AFS met Apr. 7 to hear Hyman Bornstein, Deere & Co., Moline, Ill., speak. Left to right at the speakers' table are: Allen Reid, past chapter chairman; Fred Kurtz, secretary; Mr. Bornstein; William Zeunik, technical chairman; Robert Spurgin III, chapter chairman; Carl Schopp, vice chairman; James A. Barrett, director; H. S. Taylor, director; Lee Edwards, membership chairman, and Chester Sears, treasurer. Photo by Henry O. Yeager, International Harvester

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TWIN CITY Chapter of the AFS met at the Covered Wagon, Minneapolis, Apr. 8 to hear W. W. Levi, Lynchburg Foundry Co., Lynchburg, Va., speak. Shown above, left to right, are: Mr. Levi, C. Fred Quest, Quest Foundry Co., Minneapolis, chapter chairman, and Harry Blumenthal, R. Lavin & Sons

(*Continued from page* 204)

mon faults of foundry practice is the improper control of combustion during melting and pouring.

"Engineered Ventilation" was discussed by Robert Finlayson, manager, commercial engineering department, H. H. Robertson Co., Pittsburgh, at the group's Apr. 21 meeting. He pointed out that man has attempted for centuries to remove contaminated air from a shelter and replace it with pure air. However, during 1922 the National Bureau of Standards began a series of ventilator tests which indicated that wide variances exist in efficiency of commercial ventilators.

According to the speaker, four natural factors move air through a ventilator: Temperature difference between inside and outside air; height of outlet above intake; stack area, and wind velocity. In conclusion, Mr. Finlayson stated that from the point of view of industrial safety and health, proper ventilation must receive increasing attention, and he recommended that qualified ventilation engineers be consulted for aid in solving industry's ventilation problems.—*Dan Reebel.*

Twin City

APR. 8 meeting of the Twin City Chapter of AFS was attended by more than 100 members and guests to hear W. W. Levi, Lynchburg Foundry Co., Radford, Va., discuss "Cupola Operations," and "The Basic Cupola."

Mr. Levi indicated that ignition of the coke bed has much to do with how the first molten iron will turn out. Use of an extra limestone charge—three times the normal—on top of the coke bed is desirable to promote a fluid slag at the first part of the run.

Total carbon at the cupola spout can be closely predicted by the formula: TC = 2.4 per cent + ½ C per cent − ¼ (S + P) per cent. To use this formula properly, scrap of known analyses or grades must be used and accurate weighing of all charged ingredients is paramount.

Mr. Levi described basic cupola operations at the Lynchburg foundry, stating that its advantages are threefold: Better carbon pickup, minimiz-

(*Continued on page* 208)

PURDUE FEF DINNER: Foundry Educational Foundation industry advisory committee of Purdue University held a dinner Mar. 14 at the university honoring students interested in the foundry industry. At bottom is a group of foundrymen who attended the dinner. At top, left to right, are: Claude B. Schneible, Claude B. Schneible Co.; B. C. Yearley, National Malleable & Steel Castings Co., speaker, and Dean A. A. Potter, who presented a certificate of aporeciation to Paul Harlan, Electric Steel Casting Co., for his efforts in modern'z-ing the Purdue foundry

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CENTRAL MICHIGAN Chapter of the AFS met Apr. 16 at Hart Hotel, Battle Creek, Mich., to hear Frederick G. Sefing, International Nickel Co., New York, speak. Shown, left to right, are: T. T. Lloyd, Albion Malleable Iron Co., chapter chairman; Charles Jarfster, David Smith and Robert Herwarth, students, Battle Creek Vocational School; G. Avery Aten, their instructor, and Mr. Sefing. Photo by Jack Eggleston, chapter photographer

(*Continued from page* 206)

ing use of pig iron; ability to operate at lower sulphur content, necessary in nodular iron practice; and higher melting temperatures attainable. Disadvantages are the need for hot blast and the high cost of refractories.

Two roundtable discussions also were held. Frank Ryan, St. Paul Brass Foundry, and Lloyd King, King Foundry, were discussion leaders at a nonferrous casting defects meetings; and Bill Carl and Dick Ovestrud, both of Minneapolis-Moline, led a session on sand control.—*J. D. Johnson, Archer-Daniels-Midland Co.*

Canton District

FINAL meeting of the current chapter season for the Canton District Chapter of AFS was held Apr. 3 at which Ben Taylor, B. F. Goodrich Co., Akron, O., was the speaker. His subject was "Today's Challenge in Human Relations." Chapter Chairman C. B. Williams, Massillon Steel Castings Co., presided and A. O. Prentice, Stark Foundry Co., program chairman, introduced the speaker.—*William T. Cole, Canton Malleable Iron Co.*

Central Michigan

A REVIEW of progress in foundry training at the Battle Creek Vocational School was presented at the Apr. 16 meeting of Central Michigan Chapter of AFS, held at the Hart Hotel, Battle Creek, Mich.

The chapter's educational committee, through the efforts of David Boyd, Engineering Castings Inc., Marshall, Mich., introduced two new foundry courses in the Battle Creek Vocational School. As special guests the chapter invited the instructor, Mr. Aten and three of his most promising students—David Smith, Charles Jarfster and Robert Herwarth. An interesting summary of the activities of the school was presented by Mr. Boyd.

Technical chairman was A. E. Rhoads, Engineering Castings Inc., and principal speaker was Fred G. Sefing, International Nickel Co. Inc., New York, who spoke on "The Foundry's Responsibility for Training Young Men." He stressed the importance of attracting the best type of individual, regardless of educational background. In addition, he emphasized the importance of well organized training programs for both new and veteran employees in both large and small foundries whereby good employees by proper training can assume greater responsibility.—*Richard Dobbins, Albion Malleable Iron Co.*

Northeastern Ohio

DISCUSSION of foundry equipment for air pollution control featured the technical program of the Apr. 10 meeting of Northeastern Ohio Chapter of the AFS. Speakers were John M. Kane, American Air Filter Co., Louisville, and A. J. Grindle, Grindle Corp., Markham, Ill.

A coffee talk by Ellis A. Wiley, director of trades training, Cuyahoga Heights high schools, on "Encouraging Youth of the Junior and Senior

(*Continued on page* 210)

NORTHEASTERN OHIO Chapter of the AFS met at Tudor Arms Hotel, Cleveland, Mar. 13. Shown at the meeting at top left are: Apprentice contest winners with educators and chapter members; center, left, Frank Oklessen, Motor Pattern Co., with Ernest E. Harkess, Ford Motor Co., speaker at the Patternmakers Division; right, left to right, A. C. Denison, Fulton Foundry & Machine Co., and Max Kuniansky, Lynchburg Foundry Co., Lynchburg, Va., speaker for the foundry group. At bottom, left, is a group from Henry Furnace Co., Medina, O. At right is a table group. Top row photos are by Sterling N. Farmer, Sand Products Corp.; those at bottom by Tom Gallagher, Lake City Malleable Co.

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(*Continued from page* 208)

High School Level," was the third of a series of talks arranged by the chapter's educational committee on foundry training of boys at the high school, trade school and college levels. Mr. Wiley described facilities and training afforded at the Cuyahoga Heights schools.

Annual report of the chapter's nominating committee for 1952-53 officers and directors, subject to election at the May meeting, included this slate: President, Frank C. Cech, Cleveland Trade School; vice president, S. E. Kelly, Eberhard Mfg. Co.; secretary, R. D. Walter, Archer-Daniels-Midland Co.; treasurer, F. Ray Fleig, Smith Facing & Supply Co.

Directors nominated for three years: J. F. Roth, Cleveland Standard Pattern Works Inc.; Edwin Bremer, FOUNDRY; W. H. Redhead, Lake City Malleable Co.; Edward Kraeger, Henry Furnace Co., Medina, O.; E. C. Jeter, Ford Motor Co. Henry J. Trenkamp, Ohio Foundry Co., was nominated to serve one year to fill the unexpired term of S. E. Kelly.

Walter L. Seelbach, national AFS president and president, Superior Foundry Inc., discussed various society activities and announced that early construction would start on the new AFS headquarters building in DesPlaines, Ill., Chicago suburb.

Arthur J. Tuscany, executive secretary-treasurer, Foundry Equipment Manufacturers Association, presided at the technical session. In discussing fume control problems Mr. Kane pointed out that air pollution is concerned mainly with the melting phase of foundry practice. Present day equipment can keep effluent air from dust collectors on shakeouts, sand systems, cleaning facilities, etc., practically free from visible escapement. Larger particles discharged by the cupola can be removed and considerable of the fine air pollution particles also can be trapped by existing equipment, but a visible discharge must be expected. Special cupola lighters will eliminate the smoke caused by starting up with a wood fire.

Collection of 75 to 80 per cent of the metallic fumes from the electric furnace is practical, although the cleaned gases discharged will still be visible. Fine fumes from nonferrous melting furnaces are difficult to collect economically.

Mr. Grindle showed a motion picture describing various applications

(*Continued on page* 212)

UNIVERSITY OF ALABAMA Student Chapter of the AFS was host to Birmingham Chapter at a meeting held at the university Apr. 18. A buffet dinner was served. Shown at the meeting, left to right, lower photo, are: J. T. MacKenzie, R. L. Farabee, Charles Donoho, John F. Drenning, and Prof. W. C. Jeffrey

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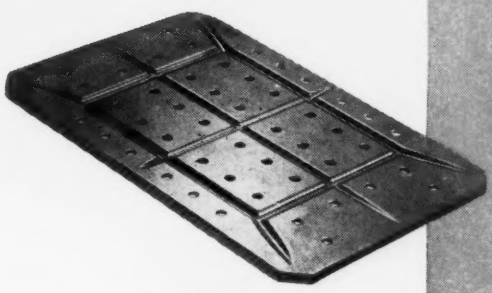

Olney Foundry was established in 1920 as a division of Link-Belt Company in Philadelphia, Pa. Olney Foundry produces gray iron castings of every description ranging in size from a few ounces to ten tons in weight. EDCO DOWMETAL Bottom Boards have been extremely helpful in maintaining the high degree of modern mechanization characteristic of Olney Foundry.

The illustrations at right show some of the foundry production equipment used by Olney Foundry to achieve their high degree of modern mechanization. The pallet-type gravity conveyor in the top panel shows molds on EDCO DOWMETAL Bottom Boards being moved to the pouring area. This pouring area is shown in the lower panel. The molds are automatically dumped after pouring and the EDCO DOWMETAL Bottom Boards are returned by the conveyor to the molder.

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ALUMINUM ALLOY INGOTS • ZINC BASE DIE CASTING ALLOYS

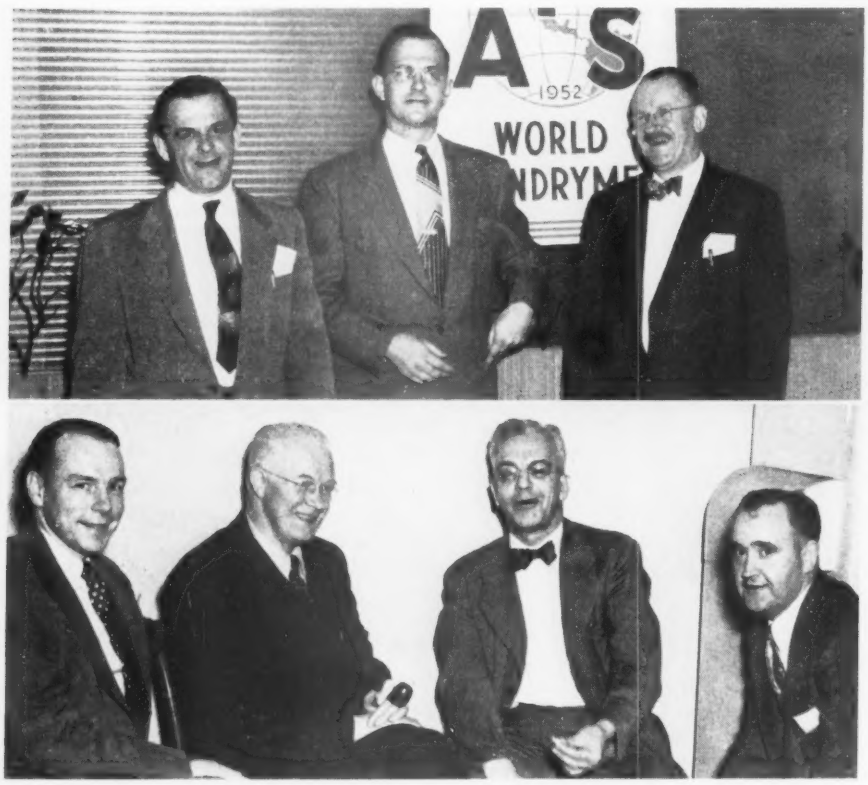
SAGINAW VALLEY Chapter of the AFS held its annual educational series for high school and trade school students on Thursday evenings during the month of March. Here students are shown at the Eaton Mfg. Co. foundry, Vassar, Mich., during the plant visitation on Mar. 20. At extreme right is Alex Hubbard, Eaton cupola supervisor, and next to him, Mr. Olson of Saginaw Arthur Hill Trade School. Photo by courtesy of John Fraker, Eaton Mfg. Co.

(*Continued from page* 210)

of dust and fume control equipment to cupolas. He mentioned that availability of glass fiber cloth has been helpful in improving the efficiency and life of the bag type collector when applied to the cupola. He described a new type hot blast system which facilitates control of dust emission, as well as offering economy in overall cupola operation.

Patternmaking division of the chapter in a separate session discussed "Question Marks of the Fattern Industry" which was somewhat unique in that Ernest F. Kindt, Kindt-Collins Co., Cleveland, the speaker, posed the questions for the audience to answer. George Gedeon, Aluminum Co. of America, Cleveland, was the moderator. Mr. Kindt pointed out that there are about 1600 pattern shops in the country which employ about 15,000 men. Questions he posed included: Does the industry have a future? What is being done relative to personnel, to the mechanical phases, and to perfecting production of better castings?

Replies from the audience indicated belief in a good future for the industry without much contraction or expansion in number of shops and employees. Patternmakers today work steadily rather than seasonally or intermittently as compared to a decade or two ago. However, the consensus was that it is difficult to interest young men in the field. One reason is that, rather than becoming craftsmen, they prefer to do monotonous work such as operating automatic machines for which the pay is higher than that for apprentices. Suggestions to combat these conditions include competent speakers to address high school students on the importance and value of being a patternmaker, keeping in close touch with the trade school and school authorities, and increasing apprentice pay.—*William G. Gude and Edwin Bremer.*



EASTERN NEW YORK Chapter of the AFS held a joint meeting with Eastern New York Chapter of the American Society of Metals Apr. 15 at Circle Inn, Lathams, N. Y. At top, left to right, are: Berkley Ellis, ASM chapter chairman; Robert Curran, General Electric Co., Schenectady, N. Y., speaker at the meeting, and John E. Waugh, AFS chapter chairman. Bottom, left to right, are: E. J. Bonesteel, AFS member; W. F. Hodges, ASM member; L. D. Fyvie, AFS member, and J. Davidson, ASM member, all of General Electric Co.

Eastern New York

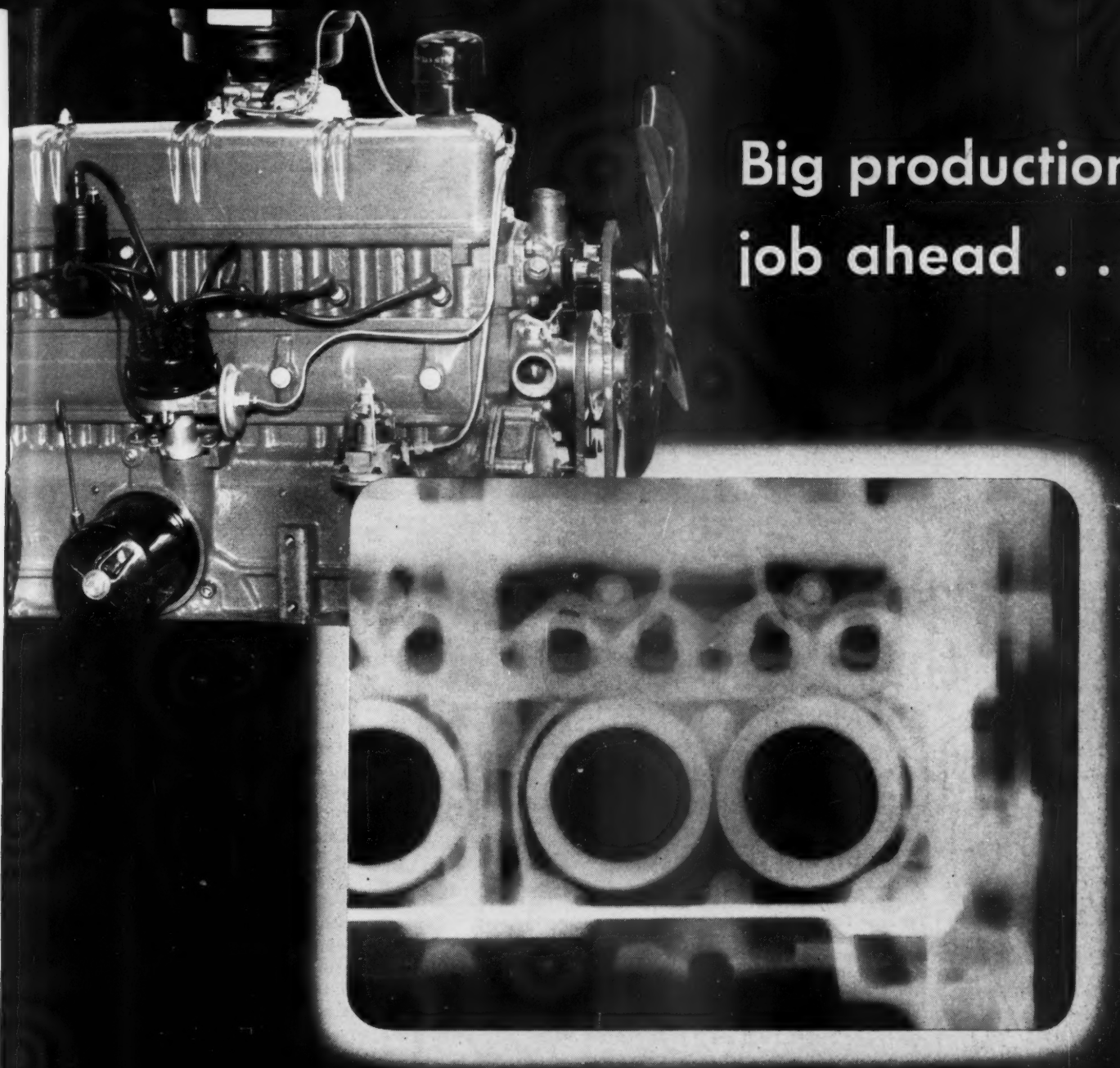
THIRD annual joint meeting of the Eastern New York Chapters of the American Society for Metals and the American Foundrymen's Society was held at the Circle Inn, Lathams, N. Y.

Robert Curran, in charge of the repair welding section of the works department for General Electric Co., Schenectady, discussed "Repair Welding of Alloy Steel Castings," using well chosen slides to illustrate his remarks.

Mr. Curran developed the idea that welding permits the reworking of castings, especially when size, intricacy and pressure requirements are such that the original casting cannot meet all specifications. Three methods of testing for defects discussed were: Magnetic, x-ray and supersonic.

Preparatory to welding, precautions must be taken to completely remove the defect but to remove as small an amount of metal as possible. In describing the gas-gouging method of removing defective metal the speaker stated that as much as 75 pounds can be removed by one operator per hour. The bead deposit must insure a sound weld, and small diameter

(*Continued on page* 214)



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Radiography . . .

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(*Continued from page* 212)

rods, such as $\frac{5}{64}$-in., serve very well.

Important in the fabrication of alloy-steel castings are: Preheating, the selection of electrode to be used, and stress-relief that must be achieved.—*Kenneth F. Echard, Eddy Valve Co.*

Rochester

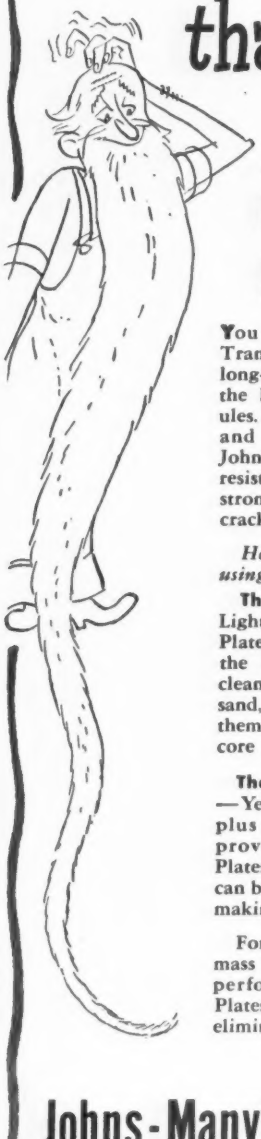
ALUMINUM casting defects and their correction was discussed by Donald LaVelle, Federated Metals Division of American Smelting & Refining Co., at the Apr. 1 meeting of the Rochester Chapter of AFS.

During the business meeting the nominating committee submitted the following recommendations for officers for the coming year: President, Leon Kimpal, Rochester Gas & Electric Corp.; vice president, Neal Clements, Rochester-Erie Foundry Co.; secretary-treasurer, Duncan Wilson, American Brake Shoe Co.

With slides, Mr. LaVelle talked informally on his subject. He said that aluminum is an easy metal to handle and that if trouble is corrected when first seen, considerable time will be saved. The most serious fault comes in pouring and handling the molten metal. It should not be puddled in the crucible and it should be stirred sparingly. Molten aluminum should be poured into a clean mold with as little turbulence as possible, maintaining a skin of metal from the lip of the crucible to the mold to minimize oxidation. Keeping the sprue filled helps to eliminate hard spots and holes in the casting.

When melting in iron pots, it is best to coat the pot to prevent contact with the metal. Nitrogen fluxing is beneficial if handled properly. To produce good castings, care must also be given to eliminate clay balls from the sand and to watch the temperature carefully.—*Herbert G. Stellwagen, Hetzler Foundries Inc.*

Looking for core plates that LAST LONGER?



. . . then use TRANSITE CORE PLATES that stay on the job year in, year out

You can rely on durable Transite* Core Plates to give long-term service, even under the heaviest foundry schedules. Made of fibrous asbestos and cement, by a special Johns-Manville process, they resist shock and corrosion, are strong and durable, will not crack or break easily.

Here are more reasons for using Transite Core Plates:

They speed production—Light-weight Transite Core Plates are easier to handle on the job. They're easier to clean, too . . . core wash, sand, etc., do not adhere to them as readily as to other core plate materials.

They maintain accuracy—Years of foundry service, plus exhaustive tests, have proven that Transite Core Plates do not warp readily . . . can be used for precision core making indefinitely.

For core plates of large mass and small surface area, perforated Transite Core Plates are also available to eliminate green cores and reduce baking time. For full details, write Johns-Manville, Box 60, New York 16, N. Y.

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Saginaw Valley

CONSIDERABLE interest was shown by members of the Saginaw Valley Chapter of the AFS in the talk on "Operation of a Basic-Lined, Water-Cooled, Hot Blast Cupola," by W. W. Levi, Lynchburg Foundry Co., Lynchburg, Va., presented at the Apr. 3 meeting. The speaker was introduced by Kenneth Priestly, Vassar Electroloy Products, Vassar, Mich., who served as technical chairman.

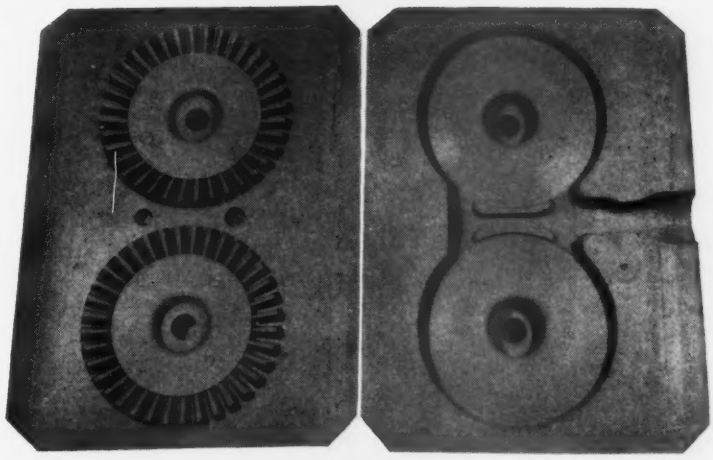
Mr. Levi described the design features of the basic-lined, water-cooled cupola now in use at the company's Redford Va., foundry. Some of the features stressed by the speaker were the tube-type water coolers used in the melting zone, water-cooled copper tuyeres, external water cooling of the shell around and below the tuyeres, the use of magnesite and carbon brick in constructing the tap hole, and the use of an externally fired air heater to preheat the blast. He also outlined the effects of varying the air blast temperature.

The chapter held its annual educational series for high school and trade school students on Thursday evenings during March. Arthur Karpicke, Central Foundry Division, General Motors Corp., was general chairman. Approximately 300 students and their instructors were enrolled for the four meetings.

The first was held Mar. 6 at North Intermediate School in Saginaw. Collins Carter, president and general manager of Albion Malleable, spoke on "Opportunities for High School and College Graduates in the Foundry Industry." He discussed opportunities in the foundry industry, explaining the functions of the Foundry Educational Foundation and how college

(*Continued on page* 218)

If you are investigating the SHELL MOLD process . . .



you will be interested in these results

With a background of more than thirty years in developing and manufacturing phenolic materials, Durez has conducted a program of research and experimentation aimed at making the shell mold process of maximum practical value in standard foundry operations. This program has produced outstanding developments, and particularly a new phenolic powdered resin and an efficient wetting agent that are extremely successful in this process. By using these to make the mix you can produce shell molds with advantages which include —

1. High strength at pouring temperatures
2. Minimum curing cycle
3. Perfect reproduction of pattern detail
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In addition, Durez engineers can help you to —

1. Utilize your present patterns and plates
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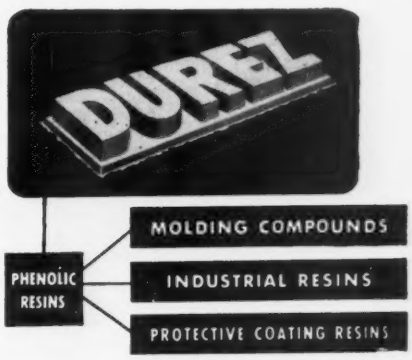
Why not let us help you to profit by the numerous economies of the new process in adapting it to your regular foundry jobs? Your inquiry will receive the prompt attention of our engineering staff.



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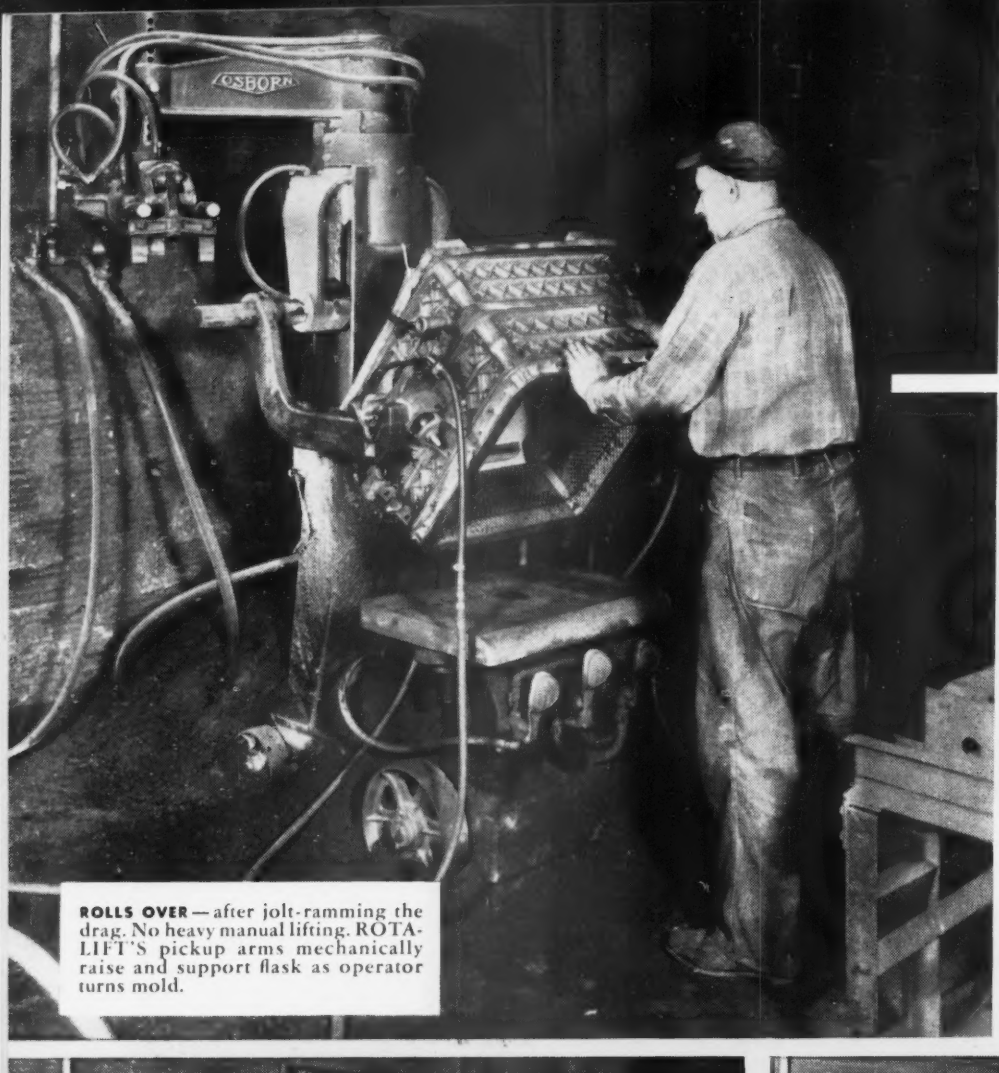


ROLLS OVER—after jolt-ramming the drag. No heavy manual lifting. ROTA-LIFT'S pickup arms mechanically raise and support flask as operator turns mold.

THE MOULDER'S HELPER

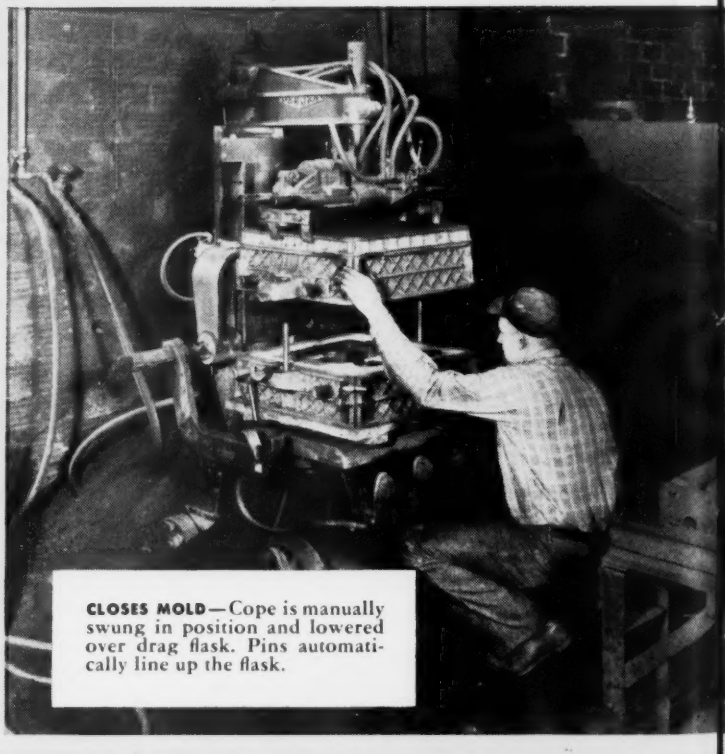
Patent No. 2,012,478.
Other patents pending.

Simplifies uctio with its jolt hanical ator to mak comple *Board* or *Learns* wit or helper. iting ti mold produ manh

Easy to e. Aft raises the pins, rol rammed the swun clamps grip flask. post) accur ws the the operator w the p is then retur lower

With ROTA is pro

DRAWS AND HANDLES COPE—After mechanical draw, air operated clamps suspend the cope completely clear of the operator's position. Gives maximum freedom to draw pattern and set cores.



CLOSES MOLD—Cope is manually swung in position and lowered over drag flask. Pins automatically line up the flask.

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MANIZES LARGE MATCH-PLATE MOLDING

fiesuction. Osborn's No. 1510 ROTA-LIFT jolt anical handling features permits one operamakcomplete molds from *Match Plates, Follow r Lorns* without the assistance of a crane, hoist r. Cuiting time is eliminated, greatly increasing oduc manhour.

o Ce. After jolt ramming the drag the operator e pins, rolls the flask over. When the cope is the swung over the table, lowered, and air grip flask. The oil controlled draw (telescopic curaws the cope which is swung to one side so ator w the pattern from the drag. The cope mold etur lowered to close the mold.

OTA is profitable to machine mold your short run castings using existing pattern equipment; resulting in increased production, accuracy, and quality of molds—reducing cost.

Versatile. One machine handles a wide range of flask sizes. It can be quickly set up for rapid change of jobs to improve production efficiency on many short run jobs. May also be used for making large cores.

Get the Facts. Your factory trained Osborn representative will gladly furnish complete details. Call or write *The Osborn Manufacturing Company, 5401 Hamilton Avenue, Cleveland 14, Ohio.*

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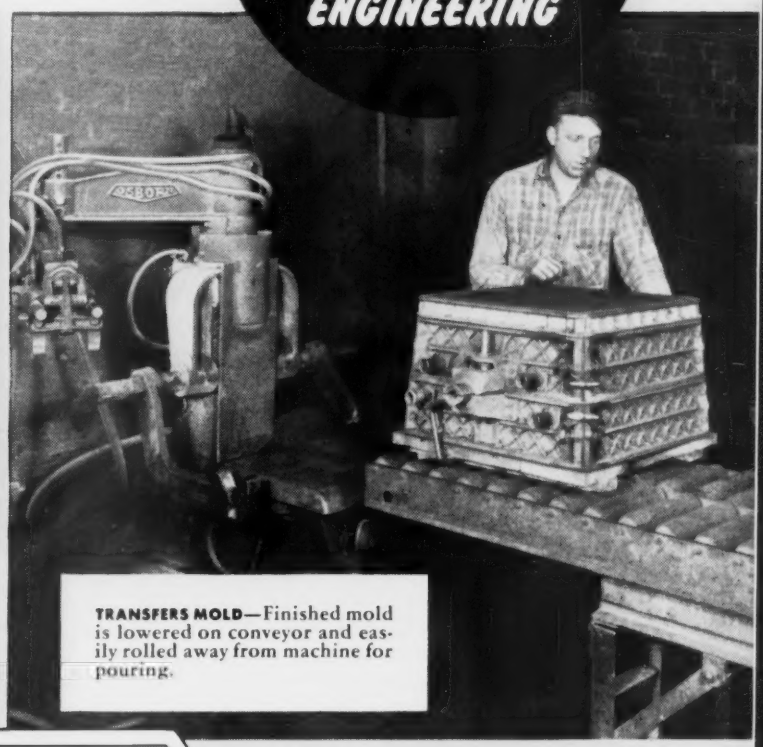
LOADS CONVEYOR—Rollover arms lift finished mold while conveyor is positioned over table.*

*(Conveyor not furnished as standard equipment)



TRANSFERS MOLD—Finished mold is lowered on conveyor and easily rolled away from machine for pouring.

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MOLDING MACHINES CORE BLOWING MACHINES INDUSTRIAL BRUSHES

FOUNDRY EQUIPMENT MANUFACTURERS ASSOCIATION INC. MEMBER FEMA

(*Continued from page* 214)
scholarships can be obtained. A Purdue University film showing the molding and casting of a small cylinder block was presented and narrated by James McDonald, Central Foundry Division, General Motors Corp.

The second meeting was held Mar. 13 at Central Junior High School in Saginaw. William Ball III, Harry W. Dietert Co., spoke on "Sand—Its Importance to the Foundry." He explained the necessity of having sand control in the prodution foundry and demonstrated the various sand tests, with Don Brewster, also of the Dietert company, assisting.

Third meeting consisted of a plant visitation to the Foundry Division, Eaton Mfg. Co., Vassar, Mich., Mar. 20. The students were shown the entire permanent mold process. Foundry executives and personnel conducted the students through the plant.

A panel discussion based on questions from the plant visitation was held Mar. 27. The panel, consisting of Eaton Mfg. Co. personnel, included Howard McClelland, foundry superintendent; Woodrow Holden, melting and molding supervisor, and George Frye, cleaning and inspection supervisor. Following the discussion, the film, "Men and Molds," produced by Lynchburg Foundry Co., Lynchburg, Va., was shown.—*Roy S. Dahmer, Eaton Mfg. Co.*

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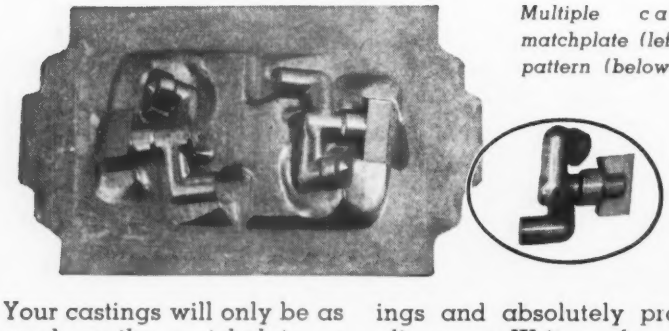
We make single- or multiple-pattern cope & drag plates from one master pattern.



Multiple casting matchplate (left) from pattern (below).

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Southern California

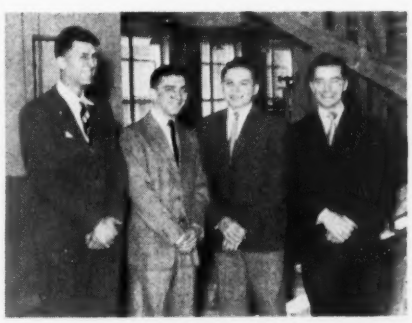
AWARDS to winners of the chapter's apprentice contest were made at the Apr. 11 meeting of the Southern California Chapter of the AFS. Principal speaker was Donald M. McCutcheon, scientific laboratory, Ford Motor Co., whose talk concerned "Non-Destructive Testing."

The speaker pointed out that, to obtain a uniform means of interpreting test results, proper equipment and personnel must be employed. The essentials of testing were described as mechanical, physical, and geometric. Among the various methods described were the light test for visual inspection; penetrating radiation by means of x-ray; use of radioactive isotopes; electrical and electro magnetic processes. All serve their purpose, but must be applied properly to determine results correctly.—*Alfred A. Grant III, Grant & Co.*

MIT

ELECTION of officers was held at the Mar. 20 meeting of MIT Student Chapter of AFS. Newly elected president is G. D. Chandley; R. F. Harris is vice president; R. E. Simmons, secretary-treasurer and R. A. Chihoski technical secretary.

The meeting's principal speaker was Prof. F. H. Norton, professor of ceramics at MIT, who spoke on "Clays, Their Chemistry and Bonding Action." He pointed out that clays, contrary to older ideas, are crystalline substances



MIT Student Chapter of the AFS elected officers at its Mar. 20 meeting. Left to right they are: R. A. Chihoski, technical secretary; R. E. Simmons, secretary-treasurer; R. F. Harris, vice president, and G. D. Chandley, president. Photo by courtesy of George Abbott, MIT

and that bentonite clay is made up of aluminum and silicon oxide layers bonded together. Fine clays have a much greater bonding action than coarser clays. He stated that in drying pure clays, the loss of volume equals the volume loss of water. Wet and dry bonding actions of pure clays are different. When wet, the clays are bound together by capillary action and upon drying, the clay assumes a definite crystalline pattern, thus reaching dry strengths of 1000 psi.—*G. D. Chandley*

Connecticut Non-Ferrous

A DISCUSSION of cobalt-60 radiography was featured at the Apr. 16 meeting of the Connecticut Non-Ferrous Foundrymen's Association. Speaker was John C. Pennock, Tracerlab Inc., Boston, who described the advantages and economy to be obtained in nondestructive testing with this radioactive material.

At the organization's Feb. 20 meeting, Norman H. Rossbach commented on the report of the British industrial team on its visits to American brass foundries in 1950. The main conclusion drawn from the team's report is that they believe they are as technically good as we are but that we are far ahead of them from a production standpoint for these reasons:

Greater incentive to earn—due to the American way of life—and the will to work hard and effectively; a closer relationship between management and employees; widespread use of a layout of simple but effective design by even the smaller jobbing foundries; maximum use of mechanical aids to conserve effort; effective use of standardization, simplification and specialization methods; use of patterns and coreboxes of high quality and accuracy; willingness to try out new methods and techniques and to expend capital on plant; attention given to planning, welfare, safety and housekeeping measures.—*Louis G. Tarantino, Niagara Falls Smelting & Refining Co., and John V. McCarthy, Federated Metals Division*

Metropolitan

OVERSEAS foundrymen who visited the United States under sponsorship of the Mutual Security Administration were welcomed on arrival in New York on Apr. 15 by Joseph Smith, assistant director for U. S. Operations of MSA; Robert Oliver, the agency's labor advisor; Lee A. Brown, MSA; Max Kuniansky, Lynchburg Foundry Co., Lynchburg, Va., and James S. Vanick, International Nickel Co., New York, chairman of the Metropolitan Chap-

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ter of the American Foundrymen's Society.

On Apr. 16 the Metropolitan Chapter had the following program arranged for the visitors: Bernard N. Ames of the Brooklyn Navy Yard U. S. Navy, discussed "Shell Molding"; R. A. Colton, Federated Metals Division, American Smelting & Refining Co., Perth Amboy, N. J., presented a talk on "Brass and Bronze." He was followed by Anthony Cristello, American Light Alloys Inc., Little Falls, N. J., whose topic was "Aluminum and Magnesium." Following lunch Harold Ullrich, Sacks-Barlow Foundries Inc., Newark, N. J. spoke on "Gray Iron and Malleable Iron." W. G. Reichert, Reichert Engineering Co., Newark, described "Mechanization in the Foundry," and A. P. Gagnebin, International Nickel Co., New York, discussed "Spheroidal Cast Iron."

April regular monthly meeting of Metropolitan Chapter of AFS, held at the Essex House, Newark, N. J., featured a talk on "Cupola Reactions, Acid and Basic" by Sam F. Carter, assistant melting superintendent, American Cast Iron Pipe Co., Birmingham. Technical chairman was W. T. Bourke, American Brake Shoe Co., Mahwah, N. J.

Mr. Carter pointed out that basic operation could be used to advantage by permitting the use of higher percentages of scrap and the use of poorer quality coke. He emphasized, however, that basic operation requires more careful supervision and technical control than acid melting and in many cases would not be economical.—*W. T. Bourke, American Brake Shoe Co., and James S. Vanick, International Nickel Co.*

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LOW COST OPERATION

- **Perfect center balance** of wheel and motor ensures grinding ease and efficiency.
- **"Worker safety"** is carefully provided.
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Cleveland Non-Ferrous

CLEVELAND Chapter of the Non-Ferrous Founders' Society met at the Cleveland Athletic Club, Apr. 10 with about 35 present. Speakers at the meeting were H. G. Dyktor, commissioner, Division of Air Pollution Control; William L. Wilson, chief, and H. C. Cutter, engineer, Bureau of Industrial Hygiene, all of Cleveland.

Mr. Dyktor discussed laws governing air pollution and the division's method of co-operating with industry in helping conform with the laws. Mr. Wilson discussed health hazards, absenteeism, lowered production rates, the difficulty in getting and holding workers in improperly ventilated foundries. Dust and fume equipment and methods of controlling air pollution were covered by Mr. Cutter.

New officers elected for the coming year are: Alfred W. Newman, Cleveland Aluminum Casting Co., chairman; Anthony Arth, Paramount Foundry Co., vice chairman; Albert Huck, Mohawk Foundries Inc., second vice chairman; Benjamin Weimer, Wellman Bronze & Aluminum Co., secretary, and D. B. Kennedy, Gluntz Brass & Aluminum Foundry Co., treasurer.—*Robert H. Herrmann*

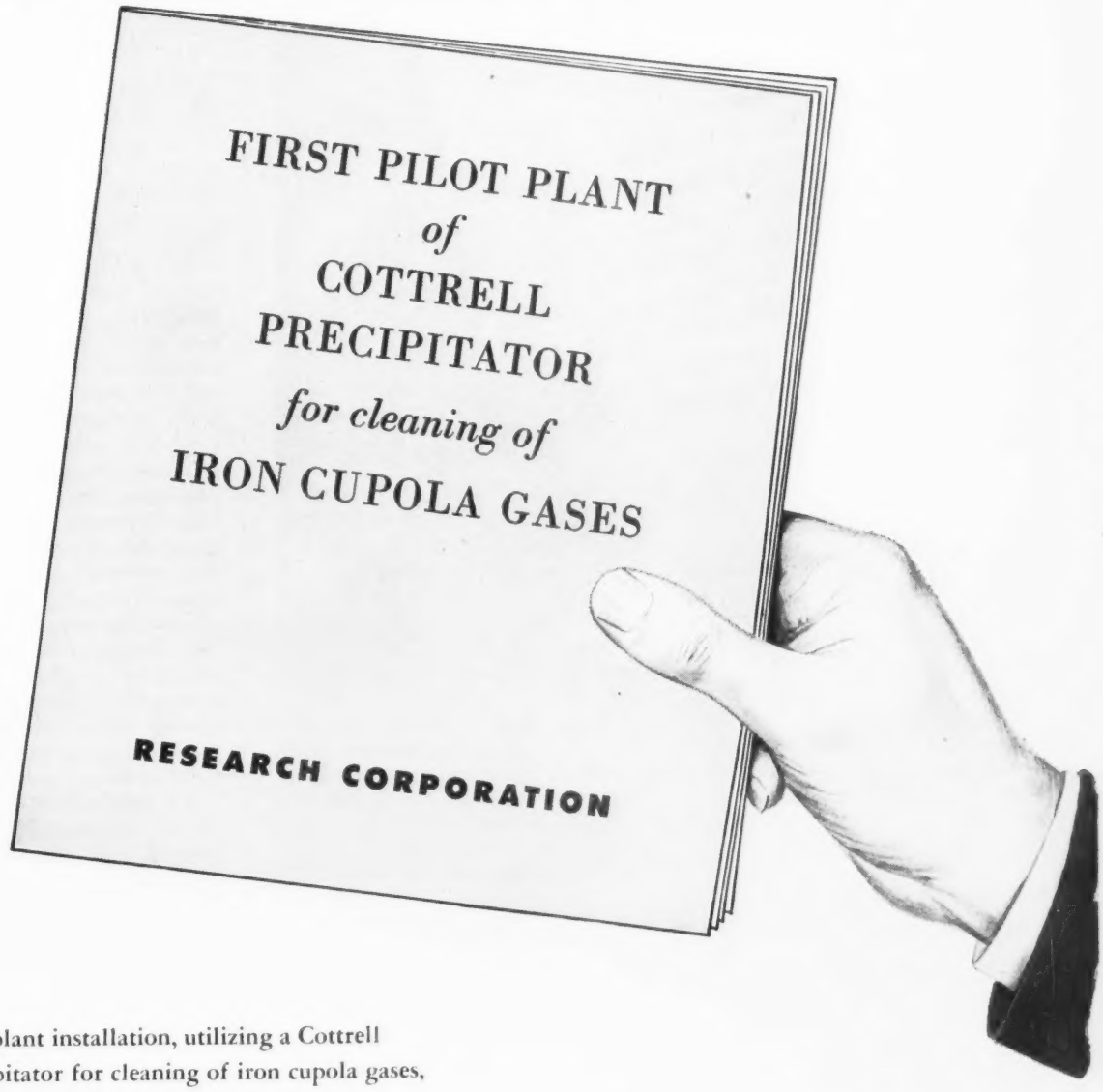
Chesapeake

A DISCUSSION of the planning required in mechanizing a small foundry was presented by William Morley, foundry superintendent, Olney Foundry, Link-Belt Co., Philadelphia, at the Apr. 25 meeting of the Chesapeake Chapter of AFS held at the Enginers Club, Baltimore.

The primary reason for mechanization, Mr. Morley stressed, is to make people more effective and a mechanized system, particularly in a jobbing foundry, must be flexible to take on all sizes of work efficiently. Planning involves listing all quantities and sizes of immovable objects involved, such as cupolas, compres-

(*Continued on page* 222)

News on a New Process



The first pilot plant installation, utilizing a Cottrell Electrical Precipitator for cleaning of iron cupola gases, had resulted in detailed findings of industry-wide importance. On the basis of facts unearthed about cupola operation and the study of the design factors involved in this project, foundries have already placed orders for 15 precipitators with Research Corporation.

Ask your Research Corporation representative to go over the findings of this first pilot plant installation with you. His recommendation on your specific problem is based on 39 years of experience in the design and erection of over a thousand Cottrell Electrical Precipitators.

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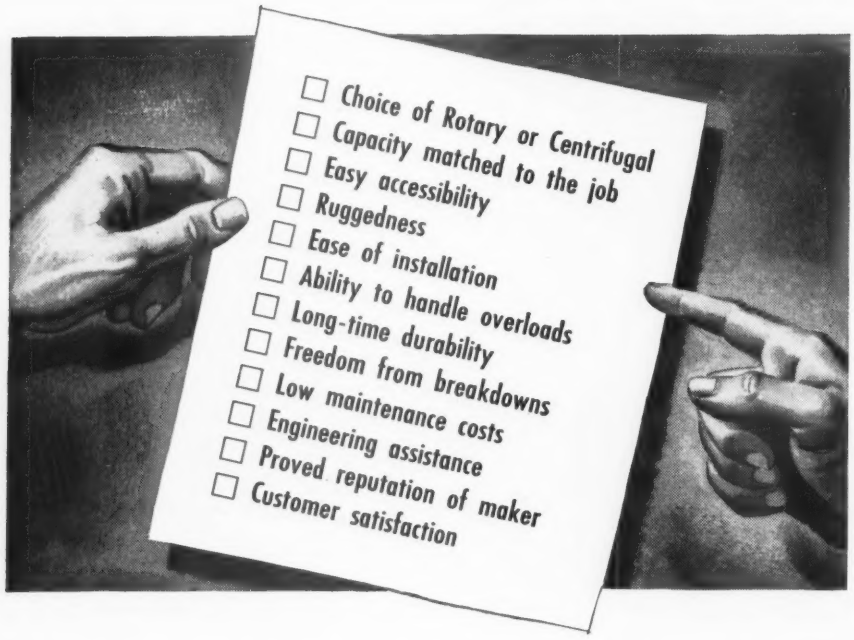

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So, for new installations or replacements, we suggest that you evaluate the equipment by the above standards of comparison. This will help determine the unit that will be most effective, economical and reliable for your specific applications.

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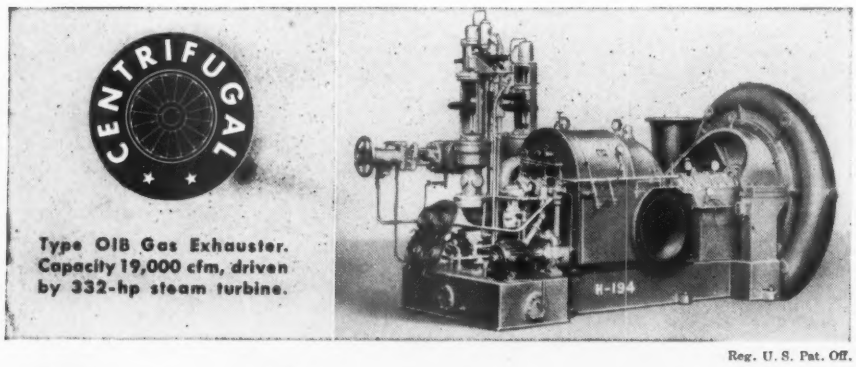

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(*Continued from page 220*)

sors, etc. Then a master plan should be formulated and followed strictly even though only a few pieces of equipment may be purchased at one time. In closing, Mr. Morley suggested that even the proper rearrangement of equipment now in a foundry could increase efficiency greatly.—*Joseph O. Danko Jr., Arlington Bronze & Aluminum Corp.*

Western New York

A DISCUSSION of "Engineers and Foundries" was presented by Dr. Douglas C. Williams, professor of industrial engineering at Ohio State University, Columbus, O., at the Apr. 4 meeting of Western New York Chapter of the AFS.

The speaker pointed out important factors the undergraduate considers before taking employment. The graduate engineer will agree to a year's training on the job, but wants to know beforehand what the future holds when that training program ends. The interviewer contacting the engineering senior must have a thorough knowledge of the company.

Dr. Williams stated the present day engineer comes to his prospective employer well trained and with an understanding of his profession. The speaker believes, however, that graduate work by the engineer is a necessity if he is to have a more thorough knowledge of a particular industry, and he urged foundries to take advantage of the higher educational institutions in their localities.

An added attraction was the showing of the color film, "The ADM of Cores," produced by Archer-Daniels-Midland Co.—*M. E. Taublieb, Frederic B. Stevens Inc.*

Central Ohio

AN excellent turnout was on hand at the Apr. 14 meeting of Central Ohio Chapter of the AFS to hear George Anselman, Beloit Foundry Co., Beloit, Wis., discuss "Casting Defects." Mr. Anselman covered some of the well known as well as less common defects which confront foundrymen. These included cracks, shrinks, blows and hot tears. He gave the basic causes and the remedies and illustrated his talk with slides of the defects considered.

At the chapter's Mar. 10 meeting, Richard Anderson, Battelle Memorial Institute, Columbus, O., presented a coffee talk entitled "Gold Mining in Africa." Principal speaker was Howard Ramsey, Archer-Daniels-Midland Co., who presented that company's film, "The ADM of Cores." The mechanics of mixing the sand, cereal,

oil and water were covered. Best test methods were given as well as methods of sand handling which would provide the best value for materials used.—*Wilfred H. White, Jackson Iron & Steel Co.*

Lancaster-York

AT a joint meeting of the Conestoga and Reading Foundrymen's Associations held Apr. 16 at Wiggins Restaurant, Lancaster, Pa., Max Kuniansky, executive vice president, Lynchburg Foundry Co., Lynchburg, Va., gave an inspiring talk on "The Future of the Foundry," before 155 members and guests.

Meeting chairman, W. T. Sheffield, Hershey Machine & Foundry Co., Manheim, Pa., introduced Thomas Belfield, Cochrane Foundry Co., York, Pa., as technical chairman, who introduced Mr. Kuniansky. The latter prefaced his talk with a film, "Men and Metal," showing foundry operations at the Lynchburg plant.

Mr. Kuniansky reviewed briefly the progress of the foundry industry the last 32 years. Desulphurization, improvement in fuels and pig irons, inoculation, introduction of scientific chemical and physical controls, development of nodular iron, foundry sand technology and the part they played in progress were discussed.

Because of such advances as shell molding, basic-lined and water-cooled cupolas, Mr. Kuniansky asked the question, "Are we at the end of our ropes?" Answering, he stated that measured by the progress of the last ten years, the future shows greatly accelerated prospects since we realize that men are the basis of progress and we are training them accordingly. Mr. Kuniansky predicted we might not be too far from making precision castings that need no special cleaning and, without machining, can be shipped from the knockout floor.—*Mark E. Mohr, Hershey Machine & Foundry Co.*

Northwestern Pennsylvania

CUPOLA practice was discussed by Tom Barlow, Eastern Clay Products Department of International Mineral & Chemical Corp., Chicago, at the Mar. 24 meeting of the Northwestern Pennsylvania Chapter of AFS. Following dinner, a film entitled "Dust and Fume Control" was shown. It included many good suggestions on apparatus to eliminate dust and fumes.

Fred Carlson, Weil-McLain Co., Erie, introduced Mr. Barlow, who emphasized the highest priced refractories do not always make the best cupola lining. He pointed out that one may start with a 42-in. diam cupola in the morning and end up with a 60-in. cupola at the end of the day. This affects cupola operation.

Mr. Barlow recommended an oval shape in the melting zone of the cupola rather than straight walls, to retard burning. The preferred refractory is one to which the slag tends to adhere, to minimize burning of the brick.—*Roy A. Loder, Erie Malleable Iron Co.*

Birmingham

ON APR. 18 the University of Alabama was host to foundrymen from the Southeastern area. A sand school was conducted by Frank Brewster, Harry W. Dietert Co., Detroit, with approximately 75 visitors attending. Following the sand session, the University of Alabama Student Chapter of AFS showed exhibits of sand testing, radiography, metallography, induction furnace melting, and carbon determination. In the evening a buffet dinner, arranged by the stu-

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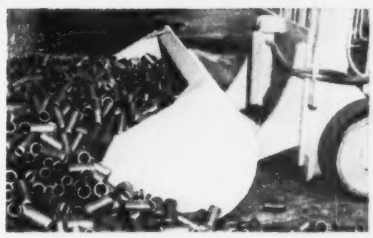

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dents, was served in the foundry by the wives of some of the students and faculty. The annual joint meeting of the Birmingham District and the University of Alabama Student Chapters followed.

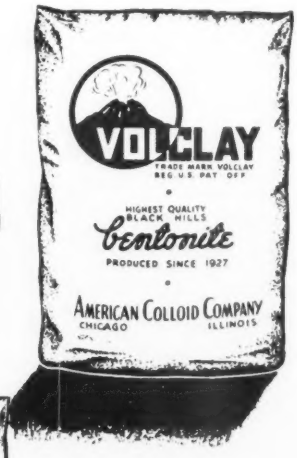
W. E. Jones, chairman of the nominating committee of the Birmingham group, submitted the following slate of officers for election at the May meeting: Chairman, Fred K. Brown; vice chairman, Biddle Worthington and secretary-treasurer, John F. Drenning.—*J. P. McClendon, Stockham Valves & Fittings, and Jack E. Bolt.*

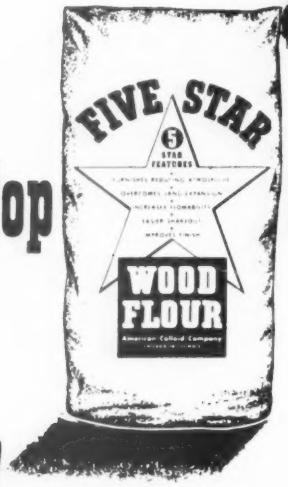
New England

THERE were 125 members and guests of the New England Foundrymen's Association present at the monthly dinner meeting held at the Puritan Hotel, Boston, Apr. 9. Following a short business meeting, a bell and striker were presented to the association by T. Fitzgerald of Draper Corp., who explained that they should serve well to call the group's meetings to order. G. D. Chandley and R. A. Chihoski of the MIT Student Chapter of AFS were present and introduced.

After dinner A. E. Blake, assistant superintendent of the General Electric foundry department, Schenectady, reviewed the observations he had made on a recent trip through many European foundries. Mr. Blake is a graduate of Rensselaer Polytechnic Institute and has been associated with the foundry industry for more than ten years. His observations were interesting, descriptive and educational.—*Myron DeHollander, General Electric Co.*

For Busy Foundrymen





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How To Get Subcontracts

Chamber of Commerce of the United States, Washington 6, has published a new booklet entitled "Subcontracting for Defense." The 36-page publication suggests that manufacturers locate the bottleneck that is slowing output on a prime contract, then show the contractor how to meet his difficulties through use of their plants under a subcontract.

The booklet indicates sources to which manufacturers may look to obtain leads. Also it suggests ways of looking ahead for subcontract opportunitis that will develop as the defense mobilization program goes forward. Copies of the booklet are available from U. S. Chamber of Commerce for 50 cents.

Enameled Iron Standard

Third edition of *Commercial Standard for Enameled Cast Iron Plumbing Fixtures,* CS77-51, is now available as a printed booklet from Superintendent of Documents, Government Printing Office, Washington 25, for 15 cents a copy. It gives standard types and sizes of enameled cast iron bathtubs, lavatories, kitchen sinks, and other widely used fixtures with requirements on materials, application of enameled coating, inspection and grading. Tests are given for acid resistance of enamel and for detecting any objectionable warpage of fixtures.

Book Review

Engineers' Illustrated Thesaurus, by Herbert Herkimer, cloth, 572 pages, 5½ x 8 in., published by Chemical Publishing Co., New York. Price $6.

Over 8000 illustrations of mechanical movements, machine parts and details are classified and arranged in this book for quick reference. Every conceivable type of machine element is clearly reproduced and identified. Where necessary an explanation of the method by which it accomplishes its particular function is given.

An Important Message to the Man Who Asks:

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When you analyze the problem of increasing core production with your present equipment you must consider the core box itself. How much time do you lose annually with costly interruptions for core box repairs: in sampling and checking when new or repaired core boxes are put into production; and in scrapped cores because of worn cavities? Think of this time as *lost production!*

Now, see how Duplicast solves this problem for you: Because with Duplicast you find that core boxes are cheaper to replace than to repair you will have extra core boxes on hand at all times and there will be no lengthy interruptions of production schedules. No sampling or checking is necessary when a new Duplicast core box is put in production—just replace the new core box and start rolling. There'll be no fins in castings from a Duplicast core box because the accurate cavities are always *exactly* duplicated. You will realize a substantial reduction in scrap and in addition save up to 80% on core box replacement costs.

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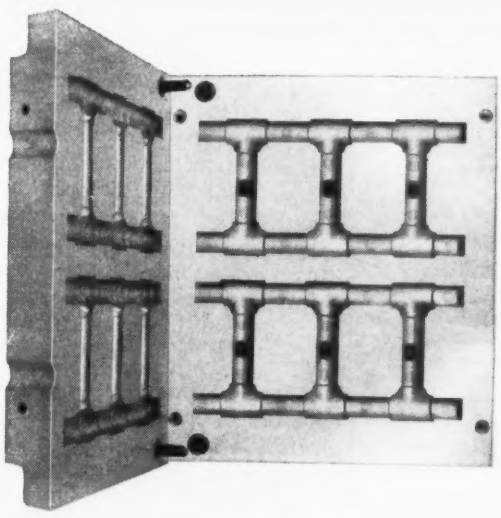

Duplicast is the ideal core box for high production schedules and for complicated irregular contoured shapes and cavities which otherwise are costly to replace or repair. Duplicast core boxes are made of a wear resistant aluminum alloy by a patented method in which a permanent hob, or mandrel, is used to duplicate any number of core boxes or dryers of exact dimensions within plus or minus .003 inches within a distance of 12 inches. Exact match on cavities can be held within plus or minus .001. Every Duplicast core box is produced with a mirror-like finish in the cavities without hand finishing or tooling of any kind.

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Ductile Iron Significance

(*Continued from page* 131)

markets that it will open to the foundry industry, and to consider what this new material may mean to countries only partially industrialized as well as those already highly industrialized.

Such a discussion involves relating its properties and applications to materials already in use, and I trust that my remarks in connection with the older materials will not be misconstrued. It necessarily follows that the introduction of a new material disturbs some of the markets that have existed for the older materials simply because the selection of a material for a particular part is a compromise of many factors, and it invariably happens in some instances that the new material is better suited than the old.

There has been some controversy over the proper terminology for this new material and it has been called spheroidal graphite iron, Ductile iron and nodular iron. Because the graphite in blackheart malleable iron is defined[5] as being in nodular form and the graphite in this new material is of an entirely different form, we prefer the first two of the names listed. Consequently, in this paper, the material will be referred to as either spheroidal graphite iron or Ductile iron. The form of its graphite, roughly spherical in shape and already a familiar sight, is shown in Fig. 1. The polycrystalline radial structure of a spheroid lighted with polarized light appears in Fig. 2.

Ductile iron has made substantial industrial progress since it was introduced. There are now approximately 140 companies which are licensed for the manufacture of this material. (Magnesium — containing cast iron is covered by patents granted or applied for in practically all industrial countries.) These companies operate about 300 foundries. Approximately half of the licensees are in the United States with the remainder spread throughout the world. Only about 3500 melt tons were processed in the United States and Canada during 1949, the first year it saw commercial production. In its second year, 1950, approximately 15,000 to 20,000 melt tons were processed. Although an accurate forecast is obviously difficult to make at the present time, it is expected that 50,000 to 100,000 melt tons will be produced during 1951 unless drastic changes occur in the industrial situation.

The commercial castings being made range from those weighing an ounce or two with a section of 1/10-in. thickness up to anvil blocks weighing 50 tons and having a section 48 in. thick. While a great variety of castings are used in the quenched and drawn condition, most of them are either in the as-cast or annealed condition. Consequently, most of the discussion of Ductile iron in this paper relates to material having a pearlitic or ferritic microstructure, although it should be emphasized that Ductile iron, like steel, can be alloyed or heat treated to provide any structure desired, including the martensitic, acicular or austenitic.

Tensile Properties—The bulk of the production of Ductile iron in the United States at present is represented by the properties shown in Table I (p. 230). Principal difference between the two as-cast grades is that the first is substantially pearlitic and thus has maximum strength, while the second, because it has a lower manganese and nickel content, has a ferritic-pearlitic structure and thus lower strength and somewhat more ductility. Annealing of either the first two grades for a few hours pro-

Bailey

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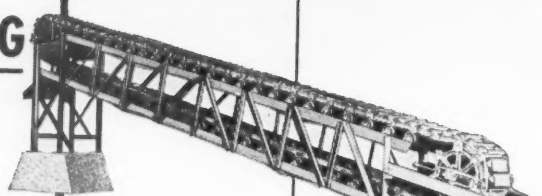

For Ferrous and Non-Ferrous Smelters and Foundries

Ruggedly constructed for low-cost service, this machine is completely self-contained. If necessary it can be moved by crane and erected wherever needed. Once it is set in place, only an electrical connection is necessary for operation. The complete unit consists of the machine proper, motor, gear unit, variable speed reducer and drive.

CAPACITIES: 3 tons per hour to 50 tons per hour. 15 ft. to 100 ft. in multiples of 5 ft.

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Bailey Stationary Wheel design eliminates 80% of the moving parts of the conventional type. The moulds are supported by endless chains that run on top of idler wheels which are mounted at stationary positions along the strand.

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duces fully ferritic structures generally having about 70,000 psi tensile strength and 20 per cent elongation. There are now a number of basic-lined cupolas in operation and with this melting unit it is possible to obtain 10 to 15 per cent elongation in the as-cast condition. The fourth grade shown is higher in phosphorus, thus is not as tough as those preceding and is used primarily in those applications requiring high strength and stiffness but involving moderate shock resistance.

As indicated in the April issue (page 203) the American Society for Testing Materials recently issued a specification for this material under the title "Tentative Specifications for Nodular Iron Castings" (A339-51T). Two grades are specified, as indicated in the following table:

Grade	Usual Conditions	Tensile Stgth., psi	Yield Stgth., psi	% Elongation
80-60-03	As cast	80,000	60,000	3.0
60-45-10	Annealed	60,000	45,000	10.0

Bars for testing include Y-bar types with ½, 1 and 3-in. sections and a keel block with 1 x 1½-in. legs. Size of coupon to represent the casting shall be at the option of the purchaser.

There is a relationship between the strength, hardness and elongation of Ductile iron. It is shown in Fig. 9 and is based on about 1000 individual 1-in. test bars taken from commercial heats as well as a number of specimens taken directly out of castings. This relation reflects the proportion of pearlite and ferrite in the microstructure and is an extremely useful attribute since it is evident that hardness is an index of strength and elongation. In other words, a hardness measurement on a particular casting, providing other conditions are met, will indicate the strength and ductility of the casting.

Consider, for example, a ladle of iron poured into keel bars and a variety of castings. If the properties of the keel bars are in harmony with the relation shown in Fig. 9, the particular heat of Ductile iron is then known to be of proper quality. The properties might be, for example, 85,000-90,000 psi tensile strength, 9.0-13.0 per cent elongation and 200 brinell hardness. Light section castings from this heat, which cooled rapidly in the mold and achieved a hardness of 250 brinell, would have a tensile strength of 100,000-105,000 psi and 2.0-5.0 per cent elongation. Heavy castings, cooling more slowly than the keel bar and having a hardness of 180 brinell, would have approximately 75,000-80,000 psi tensile strength and perhaps 15.0-20.0 per

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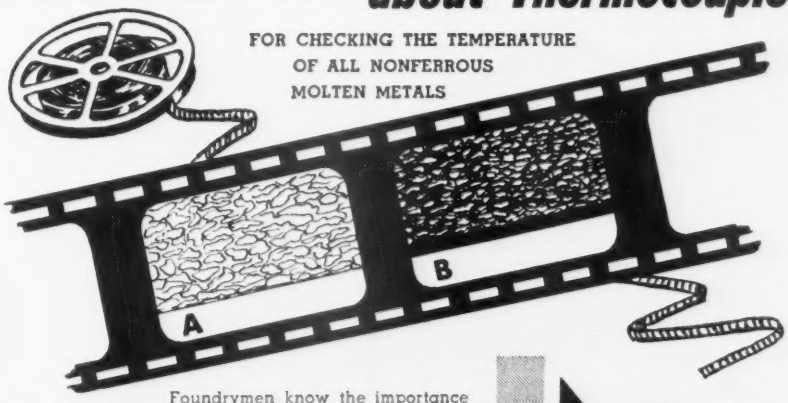

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In the above drawing "A" shows the normal grain structure of the plain tube and "B" the same tube after it has been processed. Change to Metalast and be assured of getting the best. They are made for all portable and wall type pyrometers with lance handles.

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KRANE KAR Lifts, Transports, and Spots loads of any shape or size up to 10 tons. Using hook or magnet, ***KRANE KAR*** safely and efficiently handles Patterns, Flasks, Molds, Cores, Sand Boxes, Rails, Ingots, Billets, Slabs, Scrap . . . and, with a bucket, Coke, Sand, Clay, Coal. Rubber-tired, gas-powered ***KRANE KAR*** works indoors/outdoors 24 hours a day!

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cent elongation. It should be understood that the relationship shown applies to Ductile iron which is free of primary carbide, which contains less than 0.1 per cent phosphorus, and which is fully sound. Obviously, improperly fed sections in castings will not have properties equivalent to those obtained in well fed bars.

Some castings now are being subjected to hardening treatments prior to service. Typical properties in the normalized or quenched and drawn conditions are shown in Table II. Ductile iron responds to heat treatment like steel. It is not particularly susceptible to cracking and can be quenched in either oil or water. Tensile strengths in the range of 150,000-180,000 psi are readily obtained and some values have been obtained even as high as 230,000 psi.

Compositions Used and Effect of Alloying Elements — A variety of compositions is used depending on the properties desired and the service for which the castings are intended. The broad compositional range and some of the specific ones are shown in Table III. It is evident that the carbon content is generally higher in Ductile iron than in the engineering grades of gray iron. The carbon equivalent, i.e., carbon plus one-third silicon, is generally in the vicinity of 4.3 per cent. It is frequently below 4.3 per cent for medium and heavy sections, whereas light sections generally utilize hypereutectic irons with a carbon equivalent up to 4.6 per cent. For example, one manufacturer, who produces perhaps 500,000 small section castings per week, melts in the basic cupola and uses a composition containing about 4.0 per cent carbon and 1.9 per cent silicon.

In a broad sense, magnesium controls the graphite form and has little effect on the matrix properties. These latter are controlled by the hardening elements such as silicon, manganese, nickel, molybdenum, chromium or other carbide-forming elements, the cooling rate of the casting in the mold and the phosphorus level. Consequently, to achieve a particular level of properties in a given casting in the as-cast condition, it is necessary to harmonize the composition with the cooling rate of the casting in the mold. It has been said that Ductile iron having the same properties from day to day cannot be produced consistently. A paper refuting this viewpoint[6] has already been published and, furthermore, it is evident that the level of properties achieved depends on the control of elements such as manganese, chromium, silicon, etc. In other words, the problem of achieving uniform properties from day to day in the as-cast condition depends chiefly on controlling the factors determining the matrix properties, including the temperature at which the castings are stripped from the molds.

The consistent achievement of spheroidal graphite itself presents no problems with the magnesium process, and this is attested to by the large number of licensees now successfully manufacturing iron with this type of graphite. Reproducibility of the properties from day to day depends on the control of the ordinary metallurgical and mechanical foundry variables such as the raw materials, the melting unit, the metal temperature, the mechanics of inoculation and so on.

Although phosphorus does not interfere with the formation of spheroidal graphite, it depreciates the properties of Ductile iron, particularly elongation and toughness. Most of the irons made in the United States contain 0.1 per cent phosphorus maximum. This element appears to stabilize pearlite and also in-

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Every half hour each of these furnaces in turn discharges its 5,000-pound charge into a ladle which is transferred by crane to a holding furnace (shown at right) of 9,000 pounds capacity. This furnace is mounted over the continuous casting machine located on the floors below, and thus is able to provide a permanent flow of molten brass to the mold. The intermixing of the charges from the three furnaces gives additional uniformity of composition.

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troduces its usual embrittling network. Its effect is milder in the annealed condition than in the as cast condition.

Some unusual elements, which are sometimes found in small proportions in certain pig irons, may interfere with the formation of the spheroidal graphite, thus rendering the irons unresponsible to magnesium treatment. Similarly, care must be exercised in the selection of scrap and other raw materials since the accidental inclusion of even traces of elements such as lead from contaminated scrap, for example, may cause bad results.

Silicon is an important alloying element in Ductile iron and Prof. F. B. Rote[7] has shown that each additional percentage increases the strength approximately 11,000 psi. The silicon level in gray iron, because of its propensity for coarsening the flake graphite, has been governed by the carbon content and the section thickness of the casting being produced. It has no marked influence on the shape or distribution of the spheroids in Ductile iron and, consequently, can be used as an alloying element. Its influence on annealed Ductile iron in various section thicknesses is shown in Fig. 4. Notice that soft, ductile materials having a yield strength of 38,000 psi with high ductility and toughness are obtained with 1 per cent silicon while very strong ferrites having yield strengths in the range of 70,000 psi and lower ductility are obtained with 4 per cent silicon.

Has Strengthening Effect

The strengthening effect of silicon is also clearly evident in the as-cast condition and is shown in Fig. 5 for sections of 1 in. and 6 in. in thickness. While silicon suppresses the formation of pearlite, thus tending to soften the matrix, its ferrite strengthening effect predominates and there is a steady rise in yield strength and hardness with increasing silicon.

The data in Figs. 4 and 5, representative of the zone midway between the surface and center of heavy sections, demonstrate the high level of mechanical properties available in heavy-section Ductile iron castings and also indicate that this material is only moderately sensitive to changes in section thickness. Consider, for example, a gear housing for a heavy vehicle ranging from ½ to 2 in. in thickness made of annealed Ductile iron containing 2 per cent silicon. There would be virtually no variation in properties throughout such a casting.

It is evident from this review that silicon, which is a widely distributed

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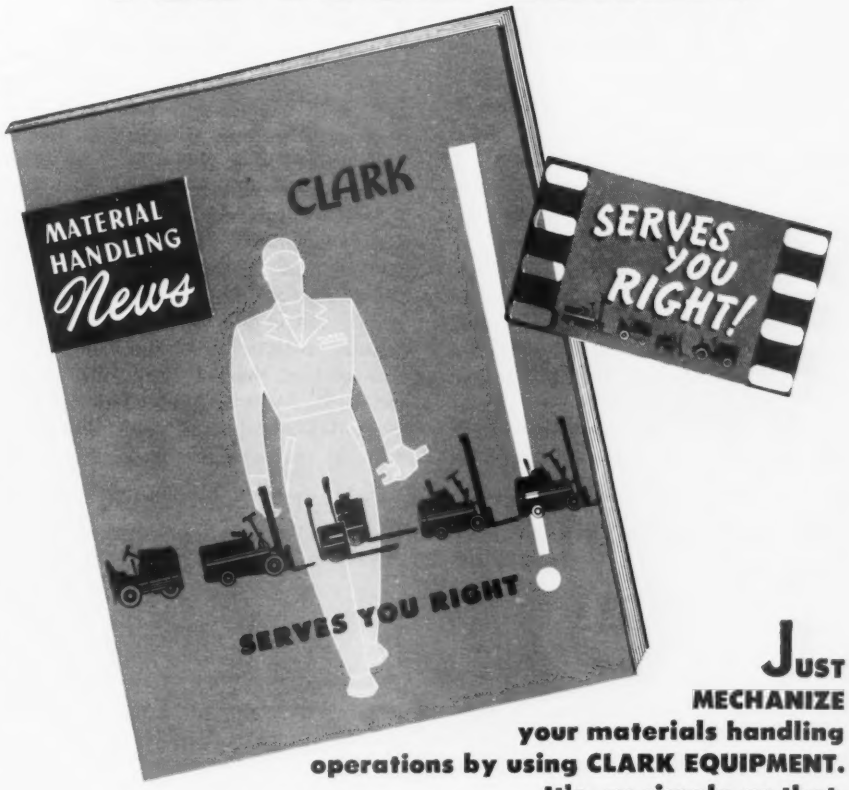

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and low cost element, will assume greater importance as an alloy in the foundry industry. On the other hand, manganese will probably become less essential. These new processes have provided sulphur-free ferrous materials on a commercial scale for the first time. Since the bulk of the manganese used is primarily for the purpose of neutralizing sulphur, there is obviously no need for manganese in spheroidal graphite irons except where it is needed for alloying purposes.

Principal Properties and Typical Castings—One feature of Ductile iron immediately recognized by foundrymen who have experimented with this material is its unusual fluidity and its ability to fill intricate molds which has continually surprised foundry observers. The president of a foundry dealing entirely with precision castings has made the statement that Ductile iron at its casting temperature is more fluid and reproduces intricate mold detail more faithfully than either aluminium or gray iron. It is not surprising, therefore, its combination of high mechanical properties with good fluidity and castability should lead to its widespread use in pressure castings.

Pressure Castings: An example of its use in this connection is the head of a reciprocating compressor shown in Fig. 3 which could not be readily cast in steel and which had inadequate properties when cast in gray iron. The manufacture of this improved compressor was delayed several years until the development of Ductile iron made possible the casting of some of the critical component parts. Extensive tests, including hydraulic fatigue and bursting tests, showed that the utility of Ductile iron for such parts is equivalent to that of ordinary cast steel and that substantial manufacturing economies are obtained especially for cylinders operating in the pressure range of 1000 to 2000 psi. The heads, cylinders and other parts of this compressor are now standard items of manufacture in Ductile iron. The same situation exists with respect to rotary compressors. Ductile iron in these complex compressor shells, again because of its castability and high strength, has made it possible to manufacture economically more efficient refrigerating machinery, because it has permitted the use of refrigerants operating at higher pressures.

Shows Superior Properties

Complex valves formerly made in bronze are now being made of Ductile iron. A high percentage of leaky castings could not be avoided with the former and it is evident from the work so far that Ductile iron will provide considerable improvement in this respect. Ductile iron pipe and pipe fittings have been approved by Underwriters' Laboratories Inc., a nonprofit organization devoted to testing materials and devices. In fact, some of the fittings have been approved for use up to pressures of 2000 psi. Many of the high-pressure intricate parts on hydraulic machinery, which have continually given trouble when made of other materials, are now being produced successfully in Ductile iron. There have been hundreds of heavy cylinders for hydraulic presses produced, and besides resisting pressure as well as cast steel cylinders, and being subject to many fewer losses due to leaky castings, the Ductile iron cylinders have a marked advantage in machinability and, therefore, in manufacturing cost. The casing and impeller for a sludge pump shown in Fig. 10 are heat treated to a hardness of 400 to 450 brinell for improved abrasion resistance.

Ductile iron should develop a tremendous number of applications in pressure castings. It has successfully replaced steel, malleable iron, bronze and gray iron in many such applications and at a substantial saving in cost. On several production runs it has been demonstrated that only 2 per cent of the castings leaked, whereas the normal loss with other cast alloys ranged from 10 to 20 per cent. In one particular instance involving 3000 castings, the rejections with Ductile iron amounted to only 5 per cent, whereas the normal rejections with other materials ranged from 20 to 50 per cent.

Another vexing problem encountered in the foundry, often with pres-

(*Continued on page 232*)

TABLE I—Representative Mechanical Properties of Commercial Heats of Ductile Iron

Tensile Strength, psi	Yield Strength, psi	Elongation, per cent	Bhn	Usual Condition
95/105000	70/75000	2.5/5.5	225/265	As-cast
85/95000	65/70000	5.5/10.0	195/225	As-cast
65/75000	50/60000	17.0/23.0	140/180	Annealed
85/95000	65/75000	1.0/3.0	230/290	As-cast

TABLE II—Heat Treated Properties of Ductile Iron

NORMALIZED AND DRAWN

	Tensile Strength, psi	Yield Strength, psi	Elongation, % in 2 in.
Air cooled from 1600° F	135,750	89,250	7.0
Air cooled from 1600° F; Drawn at 1100° F	137,000	93,000	7.0
Air cooled from 1600° F; Drawn at 1200° F	138,000	95,000	8.0

OIL QUENCHED AND DRAWN

	Tensile Strength, psi	Yield Strength, psi	Elongation, % in 2 in.
Oil quench from 1550° F; Drawn at 900° F	152,750	136,250	9.0
Oil quench from 1550° F; Drawn at 1000° F	152,750	137,250	4.0
Oil quench from 1550° F; Drawn at 1100° F	135,500	121,500	7.5
Oil quench from 1550° F; Drawn at 1200° F	101,250	84,000	10.0

NOMINAL COMPOSITION, %

TC	Si	Mn	P	S	Ni	Mg
3.50	2.30	0.35	.05	.01	1.25	0.06

TABLE III—Composition Range

	C	Si	Mn	P	Ni	Mg
Broad-range, per cent	3.2/4.2	1.0 /4.0	0.1/0.8	0.10	0/3.5	0.05/0.10
Ferritic high-ductility, per cent	3.6/4.2	1.25/2.0	0.35	0.08	0/1.0	0.05/0.08
Ferritic high-strength, per cent	3.4/3.8	2.25/3.25	0.35	0.10	0/1.0	0.05/0.08
Pearlitic high-strength, per cent	3.2/3.8	2.25/2.75	0.6/0.8	0.10	1.5/3.5	0.05/0.08

TABLE IV—Comparative Machinability of Ductile Iron, Flake Graphite Iron, and Steel*

Material as Cast	BHN	UTS psi	% Elong.	Cutting Speed in Feet per Minute: For tool life corresponding to 200 cu. in. of metal removed	Cutting Speed in Feet per Minute: For tool life of 60 minutes
Acicular—flake graphite	263	59,700	0	150	160
Ductile iron	265	97,250	2	200	210
Gray iron	225	45,000	0	310	280
Ductile iron	215	93,000	4	310	315
Gray iron	195	35,000	0	325	320
Ductile iron	207	84,700	17.5	420	370
Annealed					
Ductile iron	183	77,000	20	600	500
Gray iron	100	15,700	0	960	810
Ductile iron	170	70,000	22	970	680
Cast steel, Grade B	149	68,000	22	475	400

Criterion of tool life .030-in. land wear. Feed—(roughing cuts) .010-in. per revolution. Depth—(roughing cuts) .100-in. Tool—Carbide (K6) for irons; (78 B) for steel; 6° true rake. Lubricant—None.

* Based on machinability program carried out under contract by Curtiss-Wright Corp. for U. S. Air Force. Machinability tests by Metcut Associates, Cincinnati.

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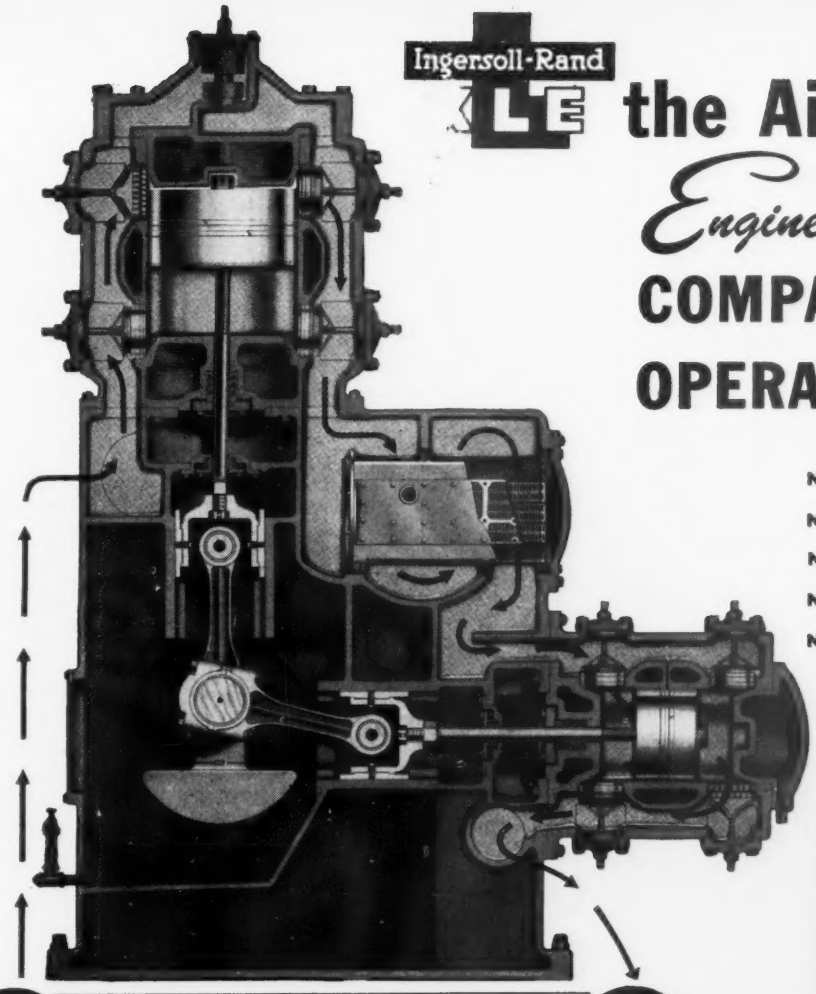

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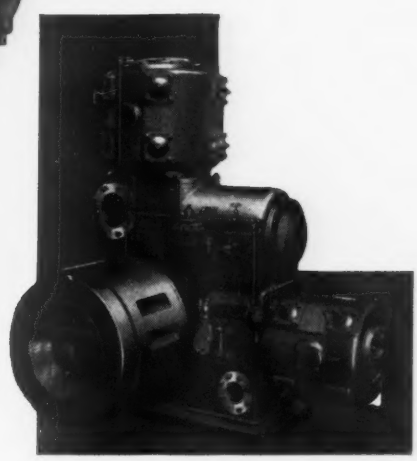

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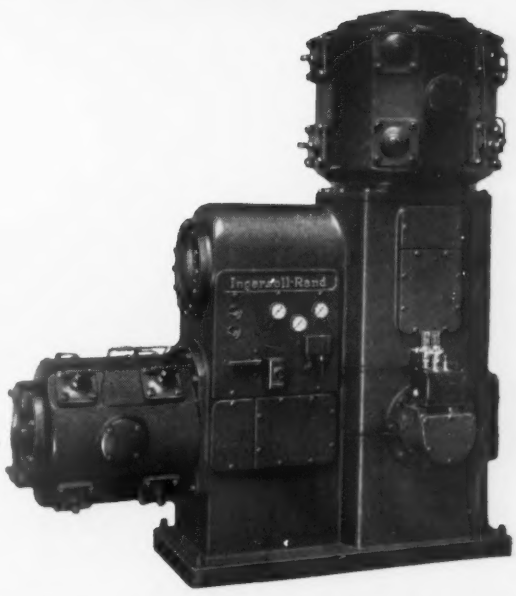

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(*Continued from page* 230)

sure castings, involves the susceptibility to hot tearing. Some casting alloys are particularly susceptible to this defect. Ductile iron does not appear to be susceptible to hot tearing and there have been no complaints reported of castings lost due to hot tearing out of the millions that have been produced thus far. One demonstration in this connection consisted of casting a plate section 48 in. long, 8 in. high and 2 in. thick terminating in a T section at each end in a hard, cement-bonded mold. Ductile iron developed no hot tearing in this test although the contraction strains were great enough to cause bending in the sections forming the T at each end. Gray iron always developed hot tears at the junction of the T sections when tested in the same way.

Wear Resistance: Another outstanding property of Ductile iron is its excellent resistance to mechanical wear in both the lubricated and unlubricated conditions. Tests made at the Bayonne Research Laboratory of the International Nickel Co. Inc. in the unlubricated conditions, indicate that its resistance to galling and scoring is equivalent to the best grades of gray iron. Other laboratory tests made by a piston ring manufacturer revealed that its wear resistance was equivalent to that of the best piston ring grade of open-grained, flake graphite iron. There are a number of applications utilizing the mechanical wear resistance of Ductile iron and their performance has even been considerably better than could have been anticipated from the laboratory results.

A typical example is one involving the bevel gears in a pump handling crude petroleum products. Gray iron gears had a service life of 300 hours and at that time showed excessive pitting and wear at the pitch line. Ductile iron gears in the same application were run over a thousand hours with no deterioration or pitting.

High Wear Resistance

Fig. 8 compares the appearance of the gear teeth on a forged steel rack and an annealed Ductile iron rack after 1500 hours' service at 50 per cent overload. The steel was badly worn and pitted during this test while the Ductile iron was burnished and showed virtually no wear. Here is an example of a part which requires the strength of mild steel and whose service life was greatly extended by improved resistance to mechanical wear. The overall cost of the Ductile iron gear rack is less than that of the steel and, needless to say, this part is now a standard production item, with thousands being made. In another application involving shock loading, where gray iron gears lasted only two weeks before some of the teeth broke and cast steel wore out in two to four months, Ductile iron has shown no signs of wear after eight months.

Ductile iron has replaced a number of bronze parts in applications involving wear. In the bearings of a rollout table of a steel mill, for example, annealed Ductile iron bearings provided a life four to five times greater than that originally obtained with bronze and at considerably lower cost. Tests on an oil piston motor showed negligible wear after 50,000 cycles of operation for Ductile iron whereas the bronze piston was badly scored and pitted. Ductile iron has performed satisfactorily in worm wheels, feed screw nuts and other parts subjected to high pressure.

A large number of parts such as cams, gears, sprockets and bearings now are being made of Ductile iron. It can be readily flame or induction

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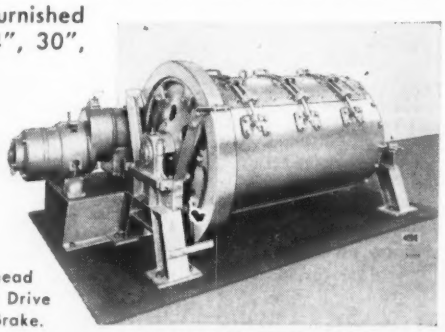

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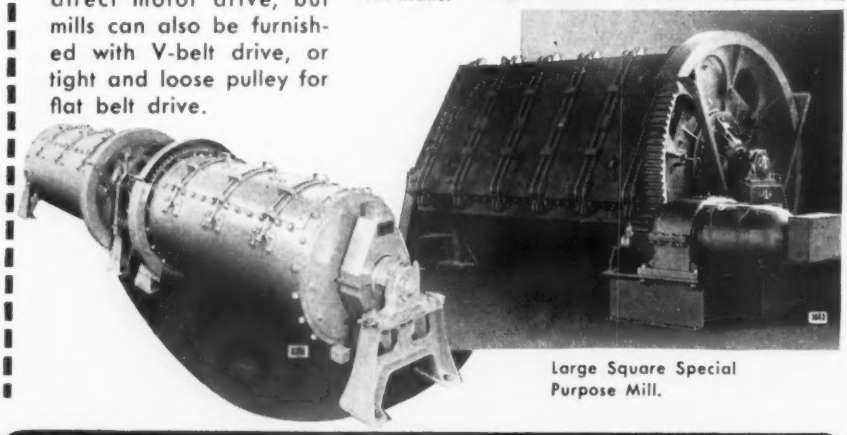

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hardened to 550-600 brinell, and under these circumstances its wear resistance is truly phenomenal. A large number of dies are now in use which are giving excellent service[9]. There are, of course, countless applications requiring wear resistance as one of the principal properties in combination with strength, toughness, stiffness and fatigue resistance which are well served by Ductile iron.

Heat and Oxidation Resistance at Elevated Temperatures: In view of the microstructure of spheroidal graphite iron, it is natural to expect that its resistance to heat and oxidation at elevated temperatures would be far superior to that of gray cast iron. This has been confirmed by laboratory tests[10, 11, 12] as well as by practical results.

Ductile iron grates in a Greenawalt sintering machine which were installed in August, 1950 were still operating in June, 1951. Gray iron grates in this same machine were replaced every six weeks. Reduction pots which had a life of 150 cycles in gray iron and failed by cracking are still operating after 300 cycles when made in Ductile iron. Ductile iron furnace doors, and there are many of these now being made, have a life three to five times greater than gray iron doors. Ductile iron pallets, used for supporting coils of wire during annealing, are produced regularly by one foundry.

Ductile iron has established a preeminent position in heat resisting applications and is widely used for a number of miscellaneous items such as tuyeres, blast furnace parts, oil burner castings, grates, annealing boxes and large pots. One of the latter used for concentrating caustic is shown in Fig. 7 and has developed substantially better life than that obtained with gray iron. Diesel engine heads require heat resistance along with toughness and strength and Ductile iron has performed well under extremely difficult conditions. A photograph of one engine head appears in Fig. 6.

Fatigue Resistance: Eagan[13], who has conducted extensive fatigue tests, has found that the fatigue resistance of Ductile iron is comparable to that of the ordinary grades of steel both in the notched and unnotched condition. This property, in combination with its wear resistance and relatively high, constant modulus of 25 million psi, makes it an ideal material for crank shafts, such as the one shown in Fig. 12, generator shafts, connecting rods, camshafts and many other types of equipment subject to alternating stresses and bearing wear. Its position in this field is well

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established and there are, for example, a large number of crankshafts now being made of Ductile iron which were formerly made of steel and high-strength gray iron. The saving in cost over forged steel in large generator shafts manufactured by one company amounts to 28 per cent.

Yield Strength in Combination with Toughness: Literally thousands of parts require a good combination of both reasonable yield strength and moderate shock resistance ranging from "C" clamps to large anvil blocks. Wide use is being made of this material for clutch plates in heavy duty tractors, one of which is shown in Fig. 11, agricultural implement parts such as hitches, brackets, front axles for tractors, gear housings, gears and many other items too numerous to detail. A start is being made in utilizing Ductile iron on transportation equipment; Fig. 13 shows an equalizer casting on a heavy trailer. The material offers opportunities for saving weight, where this is important, and at the same time increases the toughness and stiffness of the structure.

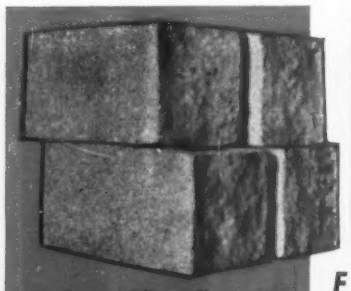
Questions are sometimes raised concerning toughness. The Charpy toughness of annealed Ductile iron is 10-15 ft lb in the notched condition and 70-85 ft lb in the unnotched condition; the values in the as-cast condition are 2-5 ft lb and 15-40 ft lb, respectively. These values are somewhat lower than those ordinarily found in steel and warrant some discussion.

The significant impact value for the large majority of applications is that required to produce a small amount of plastic deformation. It is rarely that required for complete fracture. There are very few applications where the impact blow required for complete fracture is of any practical interest. A gear tooth which is bent 5° renders a gear just as inoperable as if the tooth were broken out. The same applies to the front axle of a tractor. If bent sufficiently to cause misalignment, a new part is required.

Withstands Shock Loads

The impact load causing a small amount of deformation is governed to a large extent by the yield strength since the energy involved is that absorbed by the total elastic deformation and a small amount of plastic deformation. When viewed in this way, it is obvious that Ductile iron will sustain the same shock loads as ordinary steel having the same yield strength. This viewpoint has been confirmed with plow points. Field tests with a tractor drawn plow have shown that a blow sufficient to bend a cast steel plow point caused no deformation or fracture in a Ductile iron point. Hundreds of thousands of Ductile iron plow points have proved successful in service, many of them in rocky soils. Ductile iron plow points also have a marked advantage in abrasion resistance, which is evident from the service history of the one shown in Fig. 19.

A number of tests have also been made measuring shock resistance, i.e., susceptibility to shattering, and although many of them cannot be described in detail, they have shown that Ductile iron is surprisingly resistant to this type of failure. One interesting incident occurred when an oyster rock bed was encountered during the installation of Ductile iron piling for corrosion tests along the sea coast. A pile driver was used to hammer the pipe through the bed and caused no cracking in the pipe even though it was struck so hard that the edges of the ½-in. steel cover plate welded temporarily to its top to receive the hammer were bent parallel to the pipe.



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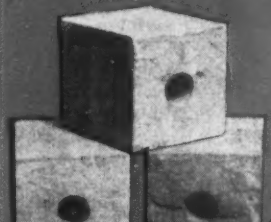

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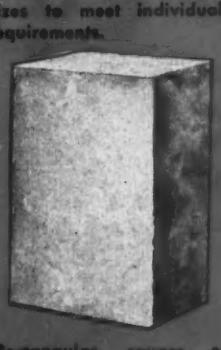

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The mechanical properties of Ductile iron indicate that it has a considerably higher yield point than most of the foundry alloys excepting, of course, the high-strength steels. This is the most important feature determining load-carrying ability and is of great interest to design engineers who usually base their designs on yield strength. Ductile iron has, therefore, a tremendous advantage in this respect and, under certain conditions, is even able to compete with aluminium on a strength-weight basis. Ductile iron diesel engine pistons are being designed which will have the same weight as the aluminium pistons currently being used. The utility of Ductile iron as a piston material is already well demonstrated, a large number of such pistons being used in diesel engines.

Weldability: Ductile iron can be readily arc welded following the techniques established for gray iron. Examination of a number of electrodes has indicated that the best type consists of a nickel-iron core wire with a carboniferous coating similar to Ni-Rod "55". By following proper techniques, it is readily possible to make welds under a variety of conditions including those of heavy restraint.

A number of Ductile iron parts are now welded in a routine fashion to steel, to highly alloyed materials and to Ductile iron itself. The tensile strength of the weld metal is about 60,000 psi and the amount of ductility will range up to 10 per cent or even higher depending on the welding and thermal conditions. Welded joints in Ductile iron pipe, welded without preheat or post-heat, have been shown to be stronger than the pipe itself under hydrostatic tests. Ductile iron is being used in several applications solely because of its weldability. There are parts in paper mill work, for example, where vanes must be welded to heavy castings which were formerly made of cast steel. Fig. 18 shows a steel pipe welded to a Ductile iron fitting. It is interesting in this connection to consider that the fitting was formerly a steel weldment which has been replaced by Ductile iron.

Machinability: The machining characteristics of Ductile iron have been reported in detail by Kahles et al[11] and a summary of machinability is given in Table IV. These data show that Ductile iron in the as-cast condition having a tensile strength of 93,000 psi is roughly comparable to gray iron of the same hardness having a tensile strength of 45,000 psi and markedly better than an acicular iron having 59,000 psi tensile strength. Its machinability in the an-

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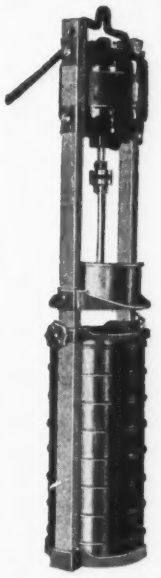

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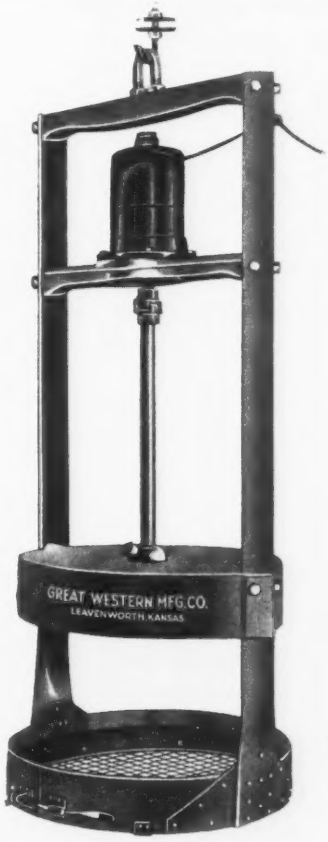

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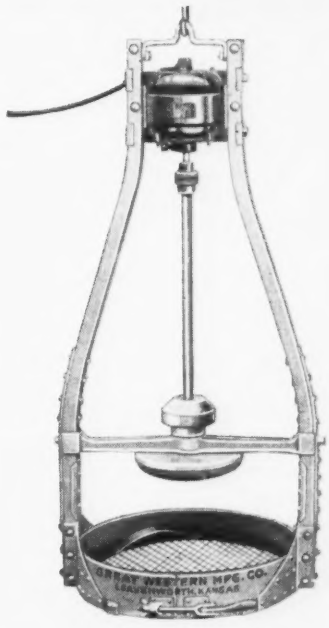

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nealed condition is phenomenal and cutting speeds of 700-900 feet per minute can be used.

Annealed Ductile iron can be machined at a rate two to three times that of good quality gray iron in the as-cast condition. Consequently, in production items such as automotive gear cases, this means that the daily output for each machine tool can be doubled or tripled by substituting annealed Ductile iron for gray iron. Stated another way, it means that the same production can be achieved with considerably fewer machine tools and thus less capital investment. In view of the savings possible, it is entirely possible that the finished cost of many items might be less in Ductile iron than in gray iron in spite of the slightly higher cost for the rough castings. Further advantages are that Ductile iron offers possibilities for weight reduction and, in addition, products having higher toughness.

Competitive Position—In considering the properties of Ductile iron, it is evident that this material combines the process advantages of cast iron with the product advantages of steel. In addition, two of the most important product advantages of cast iron, namely, its resistance to mechanical wear and machinability, are retained. Its broad range of properties overlap those of gray iron, malleable iron and steel. In fact, under certain conditions, its utility overlaps that of bronze and perhaps even aluminium. It shows promise of becoming the most broadly useful of all of the foundry alloys.

If one were forced to choose a single cast material for all purposes, Ductile iron would be a logical choice. It has fewer limitations than the older materials and the excellence of certain of its individual properties, as well as its unique combination of properties, collaborate to give it a highly favorable competitive position.

A more important aspect of its influence on the foundry industry is that it will create new applications and new uses for foundry products. When its properties become better understood and appreciated, design engineering will gradually begin to make use of its particular combination of properties in new articles that cannot be foreseen today. This has been the history of all new materials. Who could have foreseen the variety and size of the markets available to plywood 15 years ago? The clutch plate in Fig. 14, originally fabricated with a bronze facing, cast iron plate and a steel hub, is now a single Ductile iron casting.

Other items now are made of this new iron that originally involved join-

ing two or three different materials to develop the desired utility in the finished part. The complex armature casting in Fig. 16 originally consisted of three separate pieces.

Many markets being served by wrought steel may become available to the foundry industry. For instance, at present 5 million tons of steel pipe are made annually in the United States. What proportion of this market could be adequately and more economically served by spheroidal graphite iron? Oil well casing, pipe for the chemical industry, piling for buildings and high pressure transmission lines may be some of the examples. One short pipe line for gas, which contained some welded joints, has already been in service for over a year and several substantial installations are now on order.

Gears may offer another challenge to the foundry industry. The ring gear shown in Fig. 17 is made of annealed, flame hardened Ductile iron. It replaced an SAE 4140 steel unit of composite construction. Very large manufacturing savings were effected by the use of a single casting. The casting shown in Fig. 15 is the lower roller for a track-type tractor which has performed satisfactorily in preliminary tests and which replaces a part made of two forgings fastened together. The large shaft in Fig. 20, used in a beater to produce wood pulp, was formerly a forging.

Suitable for Crankshafts

Crankshafts provide another interesting market now largely served by steel. With the same fatigue resistance, better wearing quality, and lower cost, why shouldn't Ductile iron capture a large market in crankshafts? It has been said that a casting offers the shortest and most economical route between raw materials and the finished product. Limitations in the properties of existing materials have prevented the fulfillment of this axiom on a broad scale, although it has been clearly demonstrated by some striking examples. In his comparison of forged and cast crankshafts, Everest[15] showed that a finished forged shaft weighing 657 lb was produced from a rough forging weighing 2520 lb while a similar finished cast shaft weighing 637 lb was produced from a rough casting weighing 700 lb.

Wrought steel products vary greatly in the efficiency of their use of material. After machining, some wrought steel products represent 50 to 70 per cent of the original ingot weight while others represent only 10 to 20 per cent. Ductile iron can give new expression and reality to the objective of producing a finished product via the shortest and most economical route. In combination with a precision casting method, such as the shell molding process, the ultimate in this direction is achieved. A small crankshaft produced by the shell molding process is shown in Fig. 21 and has dimensional accuracy within a few thousandths of an inch. Automotive crankshafts which require no machining are being made by this process. They are stripped from the molds, stress relieved, the journals ground, and they are then ready for service.

Precision molding, in combination with Ductile iron, provides a powerful competitive combination. It will provide parts having utility equivalent to forgings in some cases; in many the precision cast Ductile iron parts may have superior quality. Another important aspect is that with the increase in world population and the demand for more metal products for higher living standards, the combination of Ductile iron and precision casting provides one way of husband-

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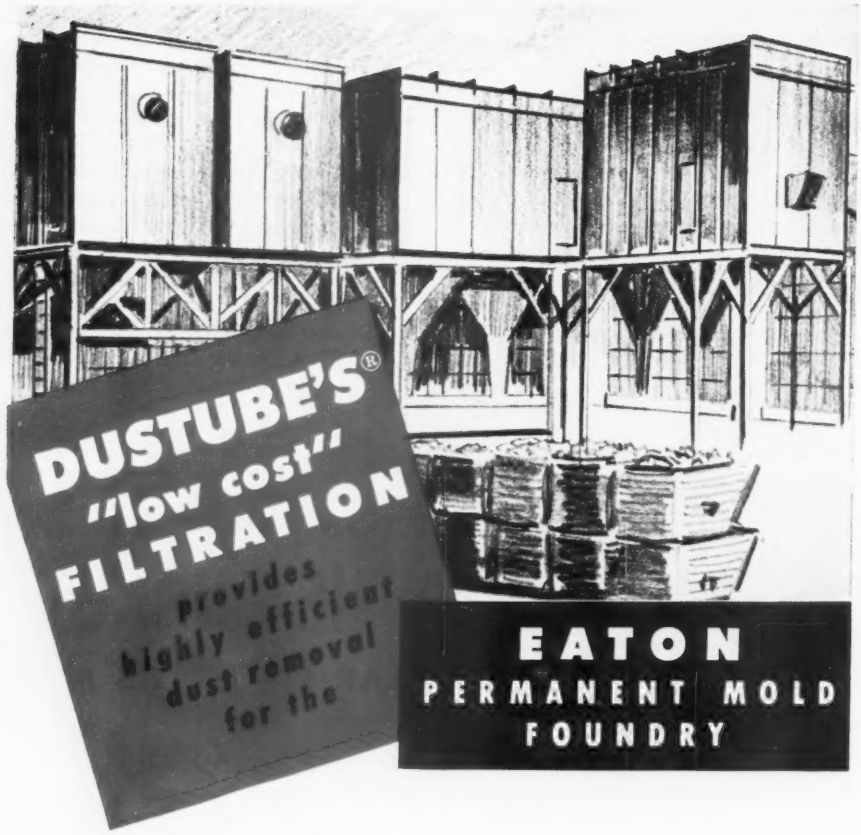
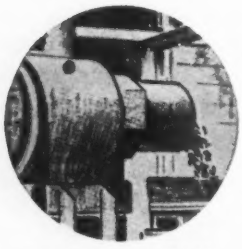
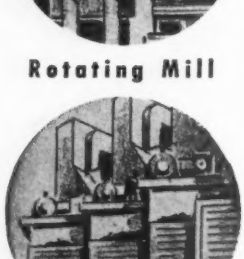


Grinding



Rotating Mill



Blast Cleaning

ALL foundry cleaning operations of the world's largest producer of permanent mold gray iron castings, the Eaton Manufacturing Company, Vassar, Michigan, are ventilated by eight Dustube Collectors. According to Mr. Edward C. Hoenicke, General Manager of the Foundry Division, they are "pleased with the low cost operation and high efficiency of the Dustubes and are very proud of the cleanliness of our cleaning department."

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ing the available supply of iron and making the most efficient use of it.

Conclusion—An industry such as a mining operation located in an area remote from the normal supply of replacement parts should find it useful to operate a foundry for the manufacture of Ductile iron. By this means such an industry could go a long way toward becoming self-sufficient. Inventory costs of spare parts would be reduced and time lost waiting for deliveries circumvented.

The broad range of utility of Ductile iron and its inherent advantages in manufacture as compared to other ferrous materials are clearly evident under such circumstances. Malleable iron is primarily useful in light castings manufactured in large quantities. Cast steel has a much broader range of utility than malleable iron but because of its lesser fluidity, is better adapted to medium and heavy sections not too intricate in design. The manufacture of either of these materials is best accomp'ished in a reverberatory or in an electric furnace and both types of installation require considerable capital investment. Furthermore, neither is completely flexible for an operation which may require a small amount of metal one day for light castings or a very large quantity of metal at another time for a single large casting.

Ductile iron on the other hand, because it can be produced in the cupola and because of its fluidity, has wide flexibility with respect to the size, intricacy and number of castings that can be produced at any given time. For example, one foundry operated by a manufacturing concern in the United States processed 120 tons of Ductile iron during the month of April, 1951. Of this, 90 tons of good castings were obtained and 415 individual parts were made ranging in weight from 5 pounds to 8,000 pounds.

It is possible with a cupola operation to meet a greatly varied demand with respect to the type of castings produced. Furthermore, less skill is required for the manufacture of Ductile iron than some of the other foundry alloys. Its compositional limits are broad and not critical, a wide variety of materials can be used for the base iron, and castings which may not meet specifications in the as-cast condition can be very simply heat treated to harmonize with the requirements. It should not be inferred from this statement that technical control is not required. However, the control is simpler and the foundry problems less than with many other materials. It is, for example, easier to manufacture Ductile

iron than it is to manufacture high strength, acicular gray iron. Its fluidity, its suitability for pressure castings and its freedom from hot tearing all contribute to the facility of its production.

Although Ductile iron would not completely fulfill the requirements of an isolated mining operation, since such items as crusher jaws and other parts requiring highly specialized properties would be required from outside sources, it is evident that a large degree of self-sufficiency would be achieved and that the industry could perhaps produce in its own foundry 90 per cent of its replacement parts.

For many of the same reasons Ductile iron should be extremely useful to those countries which are not yet fully industrialized. The capital investment can be considerably lower than that for the manufacture of other materials. This permits a larger number of units and a larger output for the same investment. With the development of the basic cupola, of which there are now a number operating in the United States producing a base iron with a sulphur content of .02 per cent, no critical or expensive materials are required. Furthermore, in an expanding industrial economy where requirements cannot be accurately forecast, the broad scope of properties available in Ductile iron should be advantageous and will allow maximum realization of new design concepts.

Large and Small Castings

Typical castings being produced in Ductile iron range from the light castings shown in Fig. 23, thousands of which are manufactured each week, to the anvil block shown in Fig. 24 which weighs 50 tons. A Ductile iron foundry could usefully serve a wide variety of industries, including agriculture, manufacturing, transportation, mining and petroleum.

In a highly industrialized country like the United States, Ductile iron permits the decentralization of production which is desirable from many viewpoints. It multiplies the available sources of supply, reduces transportatiton costs, and in many cases reduces manufacturing costs. Greater flexibility is achieved with a number of small units as compared to a large single one, and the industrial economy as a whole can accommodate greater fluctuations in the size and the nature of the demands made on it. It is generally more readily possible to make rapid changes in small operations than in large ones.

Furthermore, many industries in the United States have found that there is an optimum size for many operations and that efficiency is sacrified when the individual units are too large. In addition, it is always advantageous to have the manufacturing unit located close to the market being served. The low capital investment required for Ductile iron makes it possible for certain industries to add a foundry to their facilities, thereby achieving greater self-sufficiency and economy. When materials are purchased from many sources in a complex operation, the uniform flow of these materials can only be accomplished through the considerable expenditure of time and money.

The invention of Ductile iron provides a new method for utilizing iron, one of the oldest and most useful metals known to man. We are confident that it is destined to become the second ranking casting material and that it will create new and broad markets for the foundry.

Acknowledgments — In connection with the industrial development of Ductile iron, the author wishes to

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acknowledge his indebtedness to the men of the foundry industry who had the faith to undertake the manufacture of a new material and whose co-operative spirit and willingness to exchange information have been largely responsible for the rapid progress made in its practical applications, to his associates in the International Nickel Co. and the Mond Nickel Co. who have unstintingly given their time and effort to this development, and in particular to D. J. Reese, who was one of the first to appreciate the broad scope of its applications and whose vision, foresight and unwavering confidence have been of invaluable assistance.

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Sources of Illustrations

Figs. 3, 12—Cooper-Bessemer Corp.
Fig. 6—Grede Foundries Inc.
Figs. 7, 11, 19—Lynchburg Foundry Co.
Fig. 10—Crown Iron Works Co.
Fig. 13—Lufkin Foundry & Machine Co.
Fig. 14—State Foundry & Machine Co.
Fig. 16—Prospect Foundry Co.
Figs. 17, 18—Black Clawson Co.
Fig. 20—Valley Iron Works Co.
Fig. 21—American Brake Shoe Co.
Figs. 22, 23—Acme Shear Co.
Fig. 24—Chambersburg Engineering Co.

Book Review

Lead Toy Casting, by G. F. Rhead, F.R.S.A.; paper; 44 pages 4¾ x 7¼ in.; 128 illustrations; published by E. A. Mortimer Ltd., 215a Uxbridge Road, London W. 13, England; price 2 shillings and sixpence net (40 cents including postage).

This little paper-covered book is practically the complete answer to the prayer of the amateur who wants to know how to make lead toy and other forms of small lead castings. The text is clear and simple and supplemented by so many illustrations that the hobbyist should have no trouble in fulfilling his ambition. The subject is presented under the following chapter headings: Types and Methods of Casting; Solid Casting; Cores; Slush and Gravity Castings; Simple Mechanical Toys; Composite Models; Mould Making.

Lighting Specifications

The 1952 edition RLM Specifications Book has been published by RLM Standards Institute, 326 West Madison, Chicago 6. It provides the latest approved specifications for industrial lighting equipment, coefficient of utilization tables, lighting distribution curves, and replicas of RLM reflector contours. The book is considered an authoritative aid to everyone connected with the purchase, specification, or recommendation of industrial lighting equipment.

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Adventures of BILL

By PAT DWYER

Illustrations by RICHEY

"PARDON ME," said the young man with the pad and pencil, "but my editor has assigned me the job of doing a story on this convention. I have attempted to interview several people, but invariably before the session was fairly under way, one or sometimes three or four boisterous individuals burst in to shake my man by the hand, to slap him on the back, and to drag him off to see Tom, Dick or Harry. All I got was the dog eye and a fat lot of good that is in the composition of a story. The last man I met paused long enough to point you out and suggest that you could tell me all I want to know."

"Just making a stab in the dark," Bill said, "was this here last gent a little weasel-eyed guy with a crooked puss and one ear more or less off the perpendicular?"

"In a general way that hits him off. Also he was chewing tobacco."

"Shorty McGee. I'll have a word with the little bum the next time I see him. That lad always was a perfect genius in getting some other person to do his work for him. I never could figure out whether he was tight or just plain lazy. In one shop where we worked together down east he was known as Moocher McGee—Mooch for short—through his uncanny ability to chew tobacco constantly without going through the formality of exchanging any coin of the realm for it. Now you meet him and ask him a civil question and he begrudges you a few minutes of his precious time. Still the same old Moocher. Did he try to borrow anything from you?"

"Well, now that you mention it, he asked for a cigaret and then absentminded like, he dropped my lighter in his vest pocket. He started to say something about a place he had discovered down the street where the beer was remarkably soothing and refreshing. Two or three noisy lads came along, nipped him by the arms and carried him off. Over his shoulder he shouted back that I should see you."

"As a sterling young reporter, I presumo you remember his exact words?"

"If you insist. Apparently he was in high good humor, heart of gold; when you call me that, smile; and all that kind of stuff. If you know what I mean."

"I get you. So he smiled, hey? Well, of course that makes a difference. Referred to me as a crocodile or a hyena, maybe, or one of the more venomous and noxious species of snakes. He always had a special gift for thinking up pet names for his friends. Some day he is going to think up one too many. Then, one of the appreciative friends will put him away for good in a pickle barrel."

"That's a funny coincidence," the reporter remarked. "What he actually said was 'I ain't got no time to talk now about the foundry. You ask old pickle-puss over there in the corner; the guy with the stogie hanging from his mouth and the hat pulled down almost to his long beak. He is the lad can give you all the dope."

"Ah, yes! My little dopey friend. If you will be kind enough to give me an inkling, just an inkling you understand, of what you intend to present in this story, I shall endeavor, to the best of my modest ability, to remove the lid and show you what makes the works tick. Are you interested in the personnel, the equipment, the notables, the expert paper presenters, the aims and objects of the society, the life history of Bill Maloney, or what possible attraction a show of this kind has for the ladies who attend in large numbers every year?

"Speak up my boy. I am not as busy as the Moocher, but I do not mind admitting that I am not overly enthusiastic in contributing precious information that is almost sure to be garbled more or less when it appears in print. I never have seen a foundry story in a newspaper that was not as full of errors as a Swiss cheese is full of holes. However, that is your worry, not mine. Proceed.'"

The young man graciously admitted the possibility of a few errors creeping in to a story where a man unfamiliar with the field had to work at top speed. That was the reason he would appreciate a brief technical description of how castings are made. Information on the other items, personnel, equipment and all that kind of stuff, he could secure from others in the ordinary routine manner.

"Well," Bill said, "I'll tell you. At one time the production of castings involved specialized training and a high degree of manual skill and dexterity. All done now by machinery and higher mathematics. In the old

(*Continued on page* 244)

Enterprising reporter gets exclusive information on modern foundry practice

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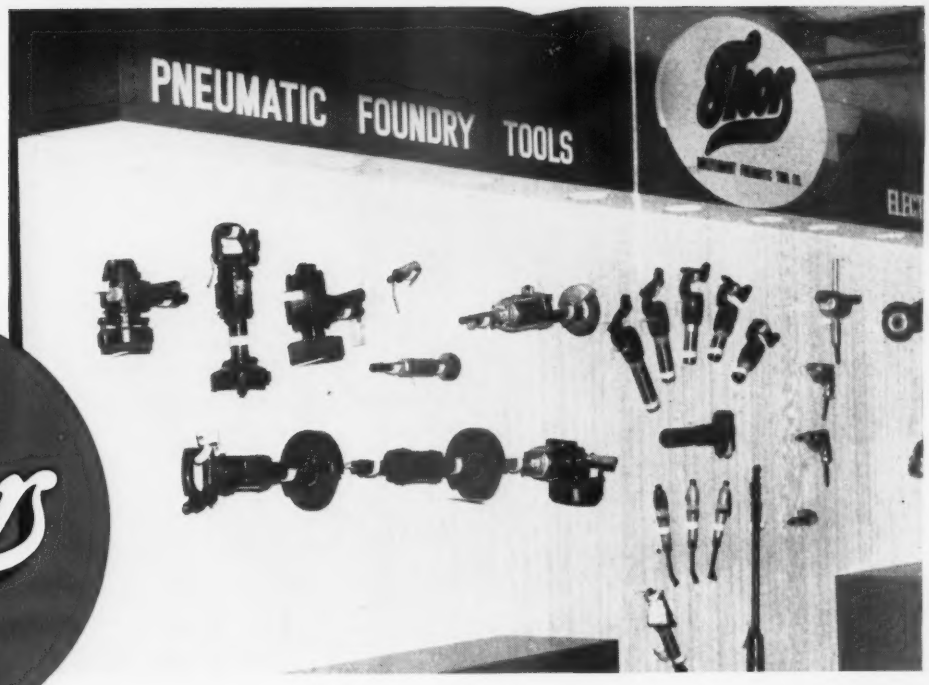

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(*Continued from page* 242)

days the molders were hard, tough, hairy guys who pounded sand all day, wore old ragged clothes and indulged in weight-lifting contests and other rough sports when off duty. Take a look at some of the birds around here at this show. Clothes that would cause Solomon and the lilies of the field to curl up and die of envy.

"This renaissance—better look that up in the dictionary—I can say it but I can't spell it—this renaissance dates back to the war years when the old hand molding methods could not keep up with the demand for castings required in our highly civilized methods of wiping large numbers of men out of existence. After the war—"

"I hate to interrupt you." The knight of the quill apparently was getting itchy. "I have a deadline to meet. How about a few words on how castings are made?"

"All very simple, my boy, all very simple. The raw sand is stored in large hoppers, where a chemical process removes offensive odors, silicosis germs and the pollen responsible for hay fever. An operator in easy negligee, sitting in a rocking chair, pushes a button at regular intervals and a measured volume of sand falls into a container. A push on a second button causes a plunger to make an impression in the sand corresponding to the shape of the desired casting.

"A large cauldron of molten metal constantly is kept simmering over an open fire. After a sufficient number of molds have been made, an attendant dips the metal out of the cauldron or pot and fills the molds. After the castings have cooled they are removed from the sand covering, trimmed on a grindstone and given away to customers for a slight consideration."

"Are you not ashamed," I said to Bill after the young man, pad and pencil had departed, "to take advantage of an innocent creature and hand out such a mess of misinformation?"

"No," said Bill, "I'm not. I had an experience many years ago that kind of soured me on truthfully answering every question fired at me. How do I know he was not kidding me? How do I know that lad was a genuine reporter? If I had told him the exact truth, how do I know that he would not distort it according to his own low concept of humor and thereby make me ridiculous? The modern newspaper reporter has neither ethics nor conscience. Accuracy never is allowed to stand in the way of a bit of sensationalism. However, this incident I had in mind was not connected directly with newspapers or reporters. It was brought to mind recently when I was asked to say a few words at a foundry meeting."

"Am I to understand that ever since you had—shall we say—a bit of a roll over the barrel, you never have told the truth to any person?"

"Well, no. I would not go that far in a statement. In the majority of instances I tell the truth, the whole truth and nothing but the truth. To smart alecks, nosey people, reporters and people who have no regard for the truth themselves, I tell just as much as I think is good for 'em!

"I had a letter recently from a man who wanted to know if I could give him the diameter and number of pop gates required for various size castings. Reminded me of the answer attributed to President Lincoln when an inquiring citizen propounded the important question: 'Mr. President, what do you consider is the proper or ideal length of a man's legs?'

"Ever the courteous and obliging gentleman, the President replied that in his well considered opinion a man's

(*Continued on page* 246)

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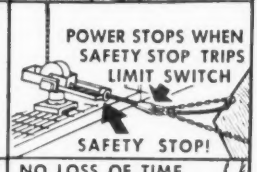

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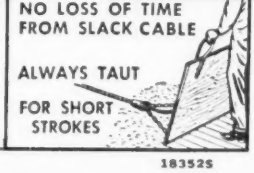

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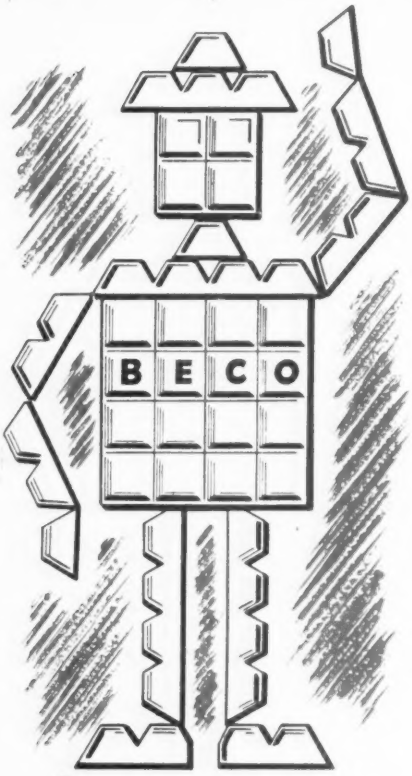

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(*Continued from page* 244)

legs should be of the proper length to reach from his body to the ground, or floor or on whatever object he happened to be standing at the time of measurement.

The basic idea in the use of pop gates, and to a certain extent in the use of any type gate, is to conduct a maximum amount of metal into the mold in a minimum period of time. Also to introduce the metal in a number of small streams to minimize the erosion effect, rather than in one or two large streams. Castings vary so widely in shape and size in comparison to weight that no hard and fast rule can be laid down. In many instances, mechanical or other factors suggest the advisability of gating the casting at or near the bottom instead of at the top.

On a thin wall pipe type of casting molded and cast in a vertical position, where the metal streams impinge on the walls of mold and core and where the mold must be filled rapidly to prevent cold shuts, metal must enter through a number of small pop gates, rectangular or circular in cross section. On a casting of equal weight, but so thick in cross section that the entering stream or streams do not touch the side walls, the gate or gates may be larger in size and less in number. Rolls and ingot molds are typical examples of large, heavy castings poured through a single gate at or near the bottom. Many factors besides time and weight enter into the problem of gate design.

Temperature is an important factor, since the metal constantly loses temperature and consequent fluidity from the time it leaves the furnace, until it enters and fills the mold. On certain types of castings the metal may be poured slowly to promote progressive solidification from the bottom. The method would be suicidal on thin castings, particularly of large area. High temperature and high pouring speed are essential to keep the metal in motion until the mold is filled. Thus for castings of equal weight, but varying in metal thickness and area, the shape, size and number of gates may vary.

It would be idle to attempt to lay down a formula for size and number of gates based solely on either the weight or the area of the casting. There are too many variables. These observations apply more particularly to shops where castings are handled in great variety. Through a system of trial and error it is possible to devise a formula for pouring speed based on the weight of a given

(*Concluded on page* 250)

pour clean aluminum

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Apex Flux cleanses molten aluminum alloys of oxides and non-metallic material present when remelting foundry scrap and helps dispel gases—a factor in producing sound homogeneous castings having the ultimate in mechanical and physical properties; improved machinability and polishing characteristics. No smoke or fumes, odorless, does not absorb moisture.

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Rice Barton

CUTS COSTS WITH

Mechanized C

Iron charges at Rice Barton are made up in the weigh hopper with scale—discharged into the cone-bottom bucket which moves by transfer car to the coke and stone bin.

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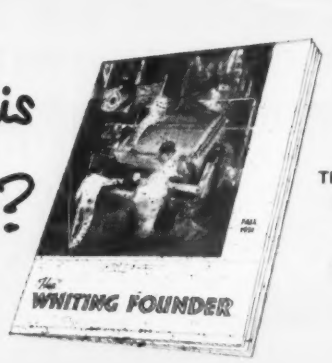

The WHITING FOUNDER gives additional details on the Rice Barton story—and other interesting information. This quarterly magazine will come to you regularly if you wish—just ask for it.

Charging!

Manual Operations Changed to a Completely Mechanized Charging System!

Previous to 1950, The Rice Barton Corp., Worcester, Mass., brought all material to the charging floor by wheelbarrow—and after charges were weighed, they were *thrown* into the cupola by hand. The charging crew consisted of 9 men, 3 of which spent the entire day making up charges.

Now, with a Whiting mechanical charging system, Rice Barton's charging crew consists of only 2 men—a crane operator and a transfer car operator. A truck crane makes up iron charges in a weigh hopper with scale which is set in an iron loading platform. The iron is discharged into a cone-bottom bucket which is then carried on a transfer car under the coke and stone bin. After receiving the required amount of coke and stone, the car moves to the cupola and a jib crane picks up the bucket and the charge is thus deposited. *All manual work is eliminated.* In addition to manpower savings, the system has greatly improved metallurgical control.

Ask for complete information on a Whiting Charging System to meet *your* needs.

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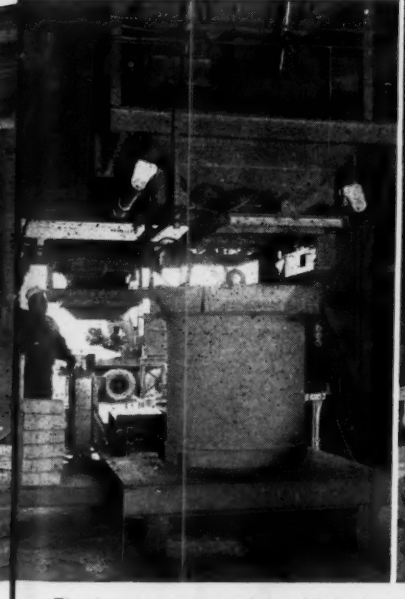
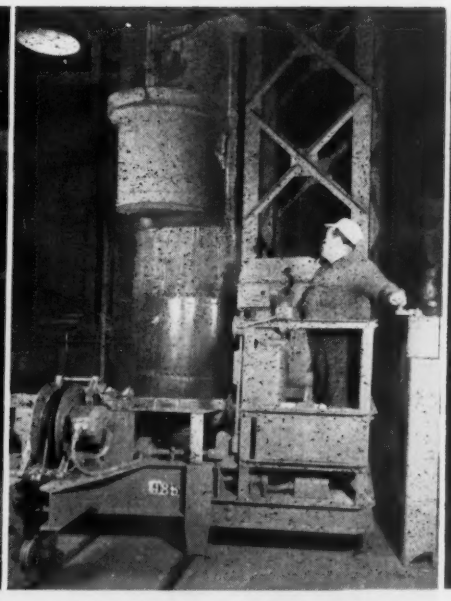


The transfer car operator weighs out the required amount of coke and stone which is then discharged into the cone-bottom bucket. Then the car is moved toward the cupola.



A jib crane picks up the bucket and the charge is deposited into the cupola. The jib crane controls are mounted on a pedestal so the operator can easily reach them without getting off transfer car.

WHITING

CHARGING EQUIPMENT

Other Whiting Foundry Products include: Cupolas • Cupola Spark Suppressors • Cupolas Hot Blast Equipment • Cupola Moisture Control Equipment • Cupola Charging Systems • Cupola Coke Igniters • Cradle Furnaces • Converters (Steel) • Duplex Melting Systems • Air Furnaces • Electric Melting Furnaces • Ladles • Ladle Handlers • Wet-type Dust Suppressors • Tumbling Mills • Annealing Ovens and Cars • Pulverizers • Pulverized Coal Firing Systems • Turntables • Electric Traveling Cranes • Trackmobile • Trambeam Overhead Handling Systems • Electric Chain Hoists

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Here is the finest quality rounded grain sand carefully screened and adaptable to new developments in the shell mold casting process. For use in core blowing machines, this sand is particularly good because its rounded grains greatly reduce the cutting out of core boxes.

In addition, Wedron can supply you with special ground sand (flour) for lost wax casting. All Wedron sand is rigidly controlled, screened to exacting standards for every casting requirement. Check with Wedron today!

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WILLOUGHBY (CLEVELAND), OHIO

(*Concluded from page* 246)

casting. This formula then may be applied to all subsequent duplicate castings, or to castings of the same approximate size and shape. A marked drop in temperature of the metal may render the most perfect gating system inoperative.

I might mention an outstanding instance of this kind described in the *Question and Answer* section of FOUNDRY about a year ago. According to the usual custom metal had been poured through a ring of twenty-two 1-in. diam pop gates on the upper flange into a loam mold for a pot 8 ft diam and 7 ft deep. The method was regarded as standard and had served satisfactorily for many years. In this particular instance the metal in the gates solidified before the mold was filled. Evidence presented at the autopsy indicated that the first metal in the ladle had flowed through a wet cupola spout with resulting loss of temperature. The cold layer of metal in the bottom of the ladle was the last to enter the pouring basin on the mold. The metal was sufficiently liquid to be tapped from the side of the basin in the usual manner at the conclusion of the pouring period, but it was not liquid enough to flow through the small pop gates.

New Visual Aids Cover Foundry Practice

Two new visual aids in teaching foundry practice are being offered by the Council of Ironfoundry Associations, 14 Pall Mall, London, S. W. 1. England. One consists of a group of ten film strips covering various types of molding operations, in addition to casting design and other phases of foundry work. Each strip is accompanied by a booklet of notes which elaborate on the points brought out in the film. The complete set is priced at £7.

The other aid is a set of 16 charts each 20 x 30 inches. With the effective use of simple illustrations and diagrams, the charts explain such subjects as sand properties, molding and coremaking methods, use of chills, types of patterns, gating practice, casting defects and their prevention, cupola melting and principles of reading a machine drawing. The charts sell for £5 per set.

Both of these aids were produced by Educational Productions Ltd. in collaboration with the Council of Ironfoundry Associations and Newton, Chamber & Co., Ltd., Thorncliffe, England. They can be purchased from Educational Productions Ltd., 17 Denbigh St., London S.W. 1, England.

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SHELL MOLD CASTING PATTERN EQUIPMENT OF ALL TYPES, COMPLETELY RIGGED.

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PERMANENT MOLDS

METALLIZING

. . . makes BUFFALO PATTERNS COST LESS

Every tap, tap, tap of the skilled silversmith's hammer adds beauty, brilliance and . . . a premium price to a fine piece of silver. A price premium that YOU never *actually* get back! But . . . this doesn't hold true with the fine craftsmanship that goes into a Buffalo Pattern

Yes, we'll admit that you will probably pay a slight premium for a Buffalo Pattern, but this small additional investment starts paying BIG dividends the day we deliver your equipment. For over half a century, the nation's largest manufacturers have been turning to Buffalo for the unhurried skill, the practical patience and the "pride in a job well done" that spell outstanding success for their important casting jobs.

They have found that Buffalo's fine craftsmanship ALWAYS produces patterns that *precisely* fit their foundries and their production schedules. They have no adapting or extra rigging to do, and the scrap ratio is so low that it more than pays the tiny difference in cost.

On your next important pattern job, let one of our engineers show you what a tremendous difference in profit, performance and production a Buffalo Pattern can make.

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DESIGNERS AND MANUFACTURERS OF PATTERN EQUIPMENT FOR OVER HALF A CENTURY

How B&W ALLMUL cuts severe service refractory costs

LEAD DROSS FURNACE

"ALLMUL proves more economical than any refractory tried!"

A plant with several reverberatory type smelting furnaces, used to melt alloys of lead, tin and antimony, carried on an extensive investigation to obtain economical refractory linings. Practically every type of refractory was tried. Side-by-side tests in the same furnace proved the economy of B&W Allmul over all others. Result? Allmul is now standard for these furnaces.

CONTINUOUS WELD PIPE FURNACE

"Three times the life in worst wear areas!"

A large manufacturer was troubled by the short life of kyanite-base refractories in certain areas of his furnace. Then B&W Allmul were installed in the uptake arches, a critical, severe-service area. Result? Allmul lasted three times as long as previously used refractories and has been ordered for general use in all areas of this manufacturer's furnaces of this type.

INDIRECT ARC FURNACE

"All furnaces converted to ALLMUL after comparative tests"

A large company making alloy steel castings has several indirect arc furnaces melting various alloys, with pouring temperatures varying from 2700F to 3100F. With highest temperature alloys, semi-mullite brick burned out in 6 to 10 heats. B&W Allmul, which cost approximately the same, showed no appreciable wear after 20 heats. On alloy steels in general, this customer reports far-less slag formation (an indication of reduced refractory wear) with Allmul than with any other refractory used. Result: All furnaces are being relined with B&W Allmul Firebrick.

ELECTRIC FURNACE ROOF

"ALLMUL lasts 3 to 6 times as long"

In a six-ton electric furnace, handling 15 tons of stainless steel per charge, super duty firebrick had to be replaced every 20 to 40 heats. Pouring temperature of the metal was in excess of 3100F, with higher temperatures attained in the furnace during periods of oxygen introduction. The owner installed B&W Allmul Firebrick, hoping for a life of 80 heats. Allmul in the first roof lasted for 122 heats—42 more than hoped for. The second roof of Allmul went to 131 heats! Result? Further orders for Allmul.

Yes, the facts about B&W Allmul Firebrick speak for themselves. This fused-mullite brick is proving its economy in dozens of severe service applications. The reason? A unique combination of refractory properties—high hot load strength, high resistance to spalling, good volume stability, a high melting point of 3335F—all resulting in lower furnace costs. Want more data? Write for Bulletin R-29.

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Increased Production

(*Continued from page* 127)

the practice is one mold to the pallet. A molding machine, a stack of pallets and a drag resting on the conveyor track are shown in Fig. 5.

Molds as they are made are placed on the pallets and rolled forward for pouring on the conveyor tracks. At end of the tracks, molds are transferred by electric hoist to a chain conveyor to be carried to two shakeouts. Pallets are returned to the molding stations on the conveyor tracks.

Molds are poured as fast as they are produced. Fig. 6 shows pouring of a mold. The shop has two cupolas, which alternate each day, and 30 to 35 tons of iron is melted daily. Synthetic silica sand mixture is used exclusively for molds, and in connection with the reconstruction program a fully equipped sand laboratory was installed. Periodic tests are made and sand is maintained under precise control.

FOUNDRY for January, 1952, p.76, described how Engineering Castings Inc., Marshall, Mich., casts 100,000 iron alloy valve seat inserts daily by the stack molding process. In the area of the foundry in which this work is produced, the company recently installed Nomad conveyors and the installation is of interest because it incorporates features not found in either the Waukesha or Slinger foundries.

Molds are Stacked

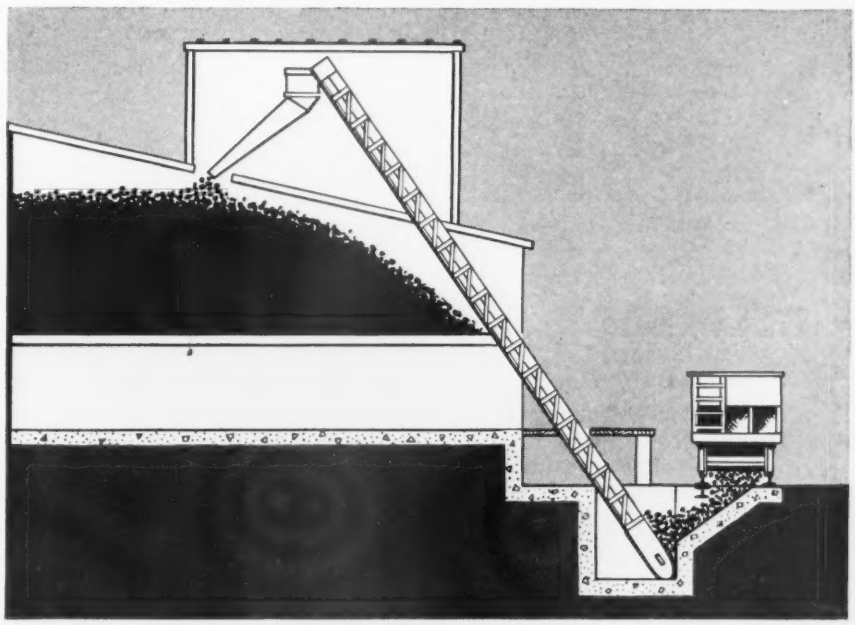
The working area in the valve insert section of the Marshall foundry is surrounded by the track conveyor on which roll small, flat-topped cast aluminum bottom boards or dollies carrying flasks and molds. The track, located only a few inches above the floor, incorporates switches to roll flasks onto track sections in front of the various furnaces for pouring direct into mold stacks. Between pouring and shakeout stations is a storage area where poured stacks may be stored awaiting shakeout to avoid congestions on the main conveyor track.

The main conveyor actually forms a complete loop so that a stack of flasks travels in a complete cycle from the molding station to the furnaces where the stack is poured, to shakeout, and back to the molding station. With all sand conditioning, as well as molding, being done inside the conveyor loops, the result is a tight, highly co-ordinated production cycle operating in a minimum of space and with a maximum of efficiency. A high production rate in

One in a series of factual reports from owners of Farquhar Conveyors

FARQUHAR CONVEYOR UNLOADS COKE 75% FASTER*

* Hardinge Manufacturing Company, York, Pa.



THIS conveyor installation, planned, designed and installed by Farquhar at Hardinge Manufacturing Company, unloads a car of coke in just 8 man-hours . . . a job that formerly required 32 man-hours. That means sizeable savings in time, labor and demurrage penalties!

Whether you move coal, gravel, sand, aggregates, cartons, boxes, bundles, bales, or any kind of bulk or packaged materials—horizontally or from floor to floor—Farquhar can cut *your* handling costs to rock bottom! One or more of the complete line of Farquhar portable, semi-permanent, and permanent conveyors will solve your handling problem. Our engineers will be glad to consult with you . . . at no obligation!

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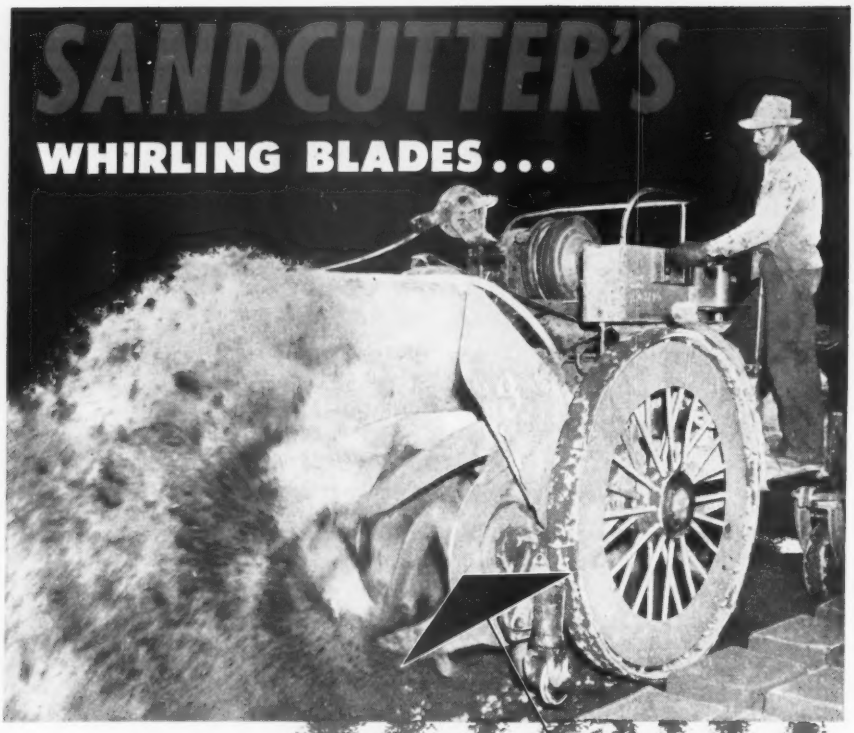
FREE! "Owners Report" —a booklet of case histories of money-saving conveyor installations. Write: A. B. FARQUHAR CO., *Conveyor Dept.* E-45, 142 N. Duke St., York, Pa., or 618 W. Elm St., Chicago 10, Ill.

WORLD'S MOST COMPLETE CONVEYOR LINE

A. B. FARQUHAR COMPANY Division of THE OLIVER CORPORATION



HELP BEAT THE COST SPIRAL

With the cost of materials and manpower steadily mounting, there is but one opportunity left for the foundryman to keep his production costs down. The answer is found in machinery and production methods that will make it possible to produce more castings . . . better castings . . . or the same number of castings in less time. The American Sandcutter does all three. It takes only one man to operate a Sandcutter. It cuts the sand right on the molding floor. There is no hand shoveling or carrying of the sand. The Sandcutter cuts through every particle of sand again and again, breaking up all lumps and evenly distributing the bond and moisture. No lump or particle can escape the whirling blades. The sand is thoroughly mixed, aerated and cooled as it is thrown into the air and tossed from side to side. It is loose, soft, fluffy and cool. It riddles fast, rams easily and vents perfectly. Because the Sandcutter conditions the sand so thoroughly, molders can put up more molds per day. The uniformity of the sand makes uniform castings. And, due to the speed and simplicity of operation of the Sandcutter, the cost of conditioning the sand per floor is extremely low. You can keep your costs down . . . with a Sandcutter.

Write for literature on any of these four Sandcutter models: Light floors (Model AM); Medium floors (Models AA and M); Heavy floors (Model K).

American® SANDCUTTER

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505 S. Byrkit St., Mishawaka 2, Ind.

total and per man-hour of labor is thus provided.

A feature of this conveyor installation is that since direction of travel of molds is required, the track incorporates curved sections and appropriate switches. These switches, one of which is shown in Fig. 7, are manually operated.

In building the stacks of molds the bottom mold is placed directly on one of the dollies resting on the conveyor track. The dolly is kept from rolling by a foot-pedal-control that holds the dolly until released. These dollies of cast aluminum are equipped with five ball-bearing rollers on the underside. Five rollers are used in this instance to assure a smooth ride through the switches in the track.

After being poured directly from the furnaces, the molds are rolled farther along the conveyor track to the storage section for cooling. This storage area, shown in Fig. 8, can hold nine movable sections of main conveyor track and each of these sections accommodates five stack molds. The facilities of track layout system for the storage of an ample number of poured stacks between the furnaces and the shakeout and for unpoured stacks between the molding stations and the furnaces provide a large degree of operating flexibility to minimize the need for synchronizing the molding, melting, pouring and shakeout operations. Cooled molds are pushed out of the storage area onto the main conveyor leading to the shakeout.

Located along a section of the conveyor track forming the rectangle around the stack molding area are a 700-lb furnace and a 350-lb electric furnace. At right angle to this track section is another track laid down in the direction of the south foundry. It is connected to the main molding area track through a switch. Along this track are located a 250-lb furnace and a 1000-lb furnace. Stack molds thus can be poured directly from any of these furnaces.

Apprenticeship Booklet

Booklet entitled "The National Apprenticeship Program," explains what apprenticeship is, the occupations in which apprentice training is given, how apprenticeship programs are established, and functions of the bureau, state apprenticeship agencies, and joint management labor apprenticeship committees.

Copies may be obtained from the Publications Branch, Bureau of Apprenticeship, U. S. Department of Labor, Washington 25, free of charge.

Casting the Superalloys

By THOMAS A. DICKINSON

"SUPERALLOYS" is the term used to describe a variety of metallic materials which comprise large combinations of ferrous and nonferrous elements. Such materials, in general, have been developed for high-temperature applications—as in the production of certain parts for jet-propulsion aircraft engines and nuclear reactors for the atomic-energy project. They are characterized by high mechanical strength and extreme chemical inertness at elevated temperatures, plus a degree of thermal shock resistance which could not be anticipated in the fabrication or use of other materials with comparable fusion temperatures.

Most superalloys can be fabricated by stamping, machining, forging, sintering, etc., if necessary; but, due to their extreme hardness and lack of ductility (particularly at low temperatures), they are fundamentally adaptable to production by more or less conventional foundry facilities.

Typical superalloys of the ferrous type (as covered by U. S. Patent 2,432,615 and manufactured by Electro Metallurgical Co.) can be indicated by the following range of compositions:

Chromium	15 to 25%
Nickel	15 to 25
Cobalt	10 to 25
Molybdenum	1 to 3.5
Tungsten	0.5 to 7.5
Manganese	up to 2
Silicon	up to 1
Carbon	up to 0.35, usually, but may go as high as 1
Nitrogen	0.05 to 0.25
Columbium, tantalum, titanium, and vanadium	0.5 to about 3, aggregate
Iron	Usually 25 to 55

Alloys of this type are usually melted in an electric furnace, either arc or high-frequency induction type; and the furnace may have either an acid or basic lining, although the latter is preferred. Iron, nickel, cobalt and molybdenum constituents are first melted under a suitable slag. Then the molten mix is deoxidized with manganese and silicon prior to the addition of chromium and tungsten, and also prior to the addition of ferrocolumbium.

Where further deoxidation is necessary, a special agent such as calcium-silicon may be used; and, thereafter, nitrogen is normally added as high-nitrogen ferrochromium. Carbon contents of the alloy are generally controlled by using suitable grades of steel in the initial mix; for this reason, the ferrous superalloys can be classed as low or high carbon materials the same as steels.

Of the latter, high-carbon alloys are preferable from the foundryman's point of view because they have the best fluidity in the molten condition. However, both types of ferrous superalloys are said to have good casting properties and can be used in accordance with the same general precautions that would be observed in work with austenitic chromium-nickel stainless steels. The alloys are most frequently cast in green or dry sand molds, although the investment process has been used successfully where precision castings were required.

High-carbon castings are susceptible to rapid work hardening and therefore cannot be machined as readily as low-carbon grades of the ferrous superalloys; but both types of castings can be finished without extreme difficulties where sharp cutting tools are used in connection with continuous cutting operations—during which a tool should not be allowed to "ride" the work. High-speed steel tools have been used for rough and finish machining, boring, milling, and sawing; but tungsten-carbide tools are generally specified for threading.

Finished castings are heat treated in accordance with the temperatures which they must withstand in actual operation, and in some circumstances no special heat treatments may be required because the operational temperatures will enable the castings to attain the desired properties.

Where the purpose of a heat treatment is to relieve internal stresses (for example, to prevent warpage), the usual practice is to bring about a mild precipitation hardening effect by heating the casting to its maximum service temperature for 2 to 4 hours. On the other hand, if heat treatments are required to improve the properties of ferrous superalloys prior to use, the following conditions may be regarded as typical:

Alloy Type	Operational Temp	Heat-treat Temp	Heat-treat time, hr	Quench
Low carbon	1200° F.	1200° F.	2	Air-cooled
Low carbon	1350° F.	2200° F.	1	Air-cooled
Low carbon	1500° F.	2200° F.	50	Water
High carbon	1350° F.	2200° F.	50	Water
High carbon	1500° F.	2200° F.	50	Water

According to officials at Stainless Steel Products, Inc., Burbank, Calif., a satisfactory pickling solution for ferrous superalloy castings comprises about 20 per cent nitric acid, 2 per cent hydrofluoric or sulphuric acid, heated to 160° F.

A typical superalloy of the type that contains relatively small quantities of iron is the Haynes Stellite No. 21 material of the following composition: Carbon 0.35 to 0.50, chromium 23.0 to 29.0, molybdenum 5.0 to 7.0, iron 2.0 (max), cobalt 30.0 (min), nickel balance.

Alloys of this type have been sand or precision cast, much the same as the aforementioned ferrous superalloys, aside from the fact that they necessitate the use of higher processing temperatures.

Most unusual of all the superalloys that have been recently developed are the so-called "metal ceramics," such as Union Carbide & Carbon Corp.'s Metamic. These materials comprise ferrous and nonferrous metals combined with metallic oxides, and are particularly interesting to the extent that they may be cast at room temperature—the way ceramics are cast.

Such casting involves the dispersion of pure metal and oxide powders in water, so as to produce a "slip" or casting emulsion which can be poured into the cavity of a porous mold. Purpose of the porous mold is to facilitate the removal of water

Comparative Properties of Typical Superalloys

Properties	Metamic LT-1 Comp.	Haynes Stellite No. 21	Electromet N-153 Alloy
Density, g/cu cm	6.0	8.3	8.145
Melting point, °F	3362	2547	2500
Tensile strength, psi	17,500	166,300	87,200
Mean coefficient of thermal expansion per °F, 32-1832° F	0.0000047	0.0000080	.....
Rockwell hardness	35C	30C	89-94B
Short-time bend strength at 2000° F, psi approx.	38,000	.....	40,000
Charpy impact strength, room temp, in./lb	11	200	150
Oxidation resistance in air, °F	2192	2100	1600
Thermal conductivity, cgs/500° F	0.12	0.034	.....

Specific Purpose Grinding Wheels

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Requirements in grinding wheels become increasingly individual. If the wheel you need isn't made, we'll make it for you. Write, wire or phone for an Electro Sales Engineer to survey your needs without obligation; and send for Grinding Wheel Manual 645 and Speed Calculator. Both free and very useful.

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WEST COAST WAREHOUSE: LOS ANGELES 58. PLANTS IN BUFFALO, N.Y. AND P.Q., CANADA

E-423

from the cast materials, with or without the use of supplementary heating equipment, so that the solids remaining in each mold cavity can be segregated as a single casting for high-temperature fusion into a finished product.

Castings thus fused have ceramic properties, such as inertness in the presence of powerful reagents and ability to withstand temperatures up to 2500° F in actual use, in accordance with the quantities of metallic oxides incorporated in the initial casting mix; yet, due to the presence of pure metallic alloys, they may have excellent mechanical strength and as much thermal-shock resistance as the aforemention superalloys.

Further, experience attained at Lockheed Aircraft Corp. reveals that the only item of special foundry equipment which may be required to produce metallic ceramics in many organizations is a mechanical agitator or mixer of the type used in preparing porcelain enamels for the finishing of cast alloys. Equipment of this type is essential to the preparation of satisfactory slip dispersions for casting purposes, but is not necessarily expensive.

Plaster molds, which may produce as many as 100 duplicate ceramic-metal casts, can be readily made with standard pattern-shop facilities; and the casts can be fused with high-temperature furnaces of the types now available in most foundries as well as with the kilns used in the production of conventional ceramic products.

Fused metal-ceramic casts are relatively brittle at room temperature, but can be machined or finished with cutting tools and grinding equipment like other superalloy products as a rule if operational speeds and pressures are appropriately reduced. Further, while the new materials require no special heat treatments to relieve stresses or to assure optimum physical properties prior to use, the fused castings can be assembled (if necessary) by pressure-welding or by brazing.

Donates Sintering Machine

Duncan Foundry & Machine Works, Alton, Ill., has donated a laboratory-type sintering machine to Armour Research Foundation, Illinois Institute of Technology, Chicago. Machine is a pilot plant model and will be used for studies of lightweight aggregates for concrete and treatment of finely divided ores. American Ore Reclamation Co., Chicago, assisted in arrangements for donation of the machine, a welcome addition to the list of institute equipment.

Foundrymen and Boys

(*Continued from page* 123)

Sometimes officials of as many as six corporations are on the campus of the University of Detroit on the same day for the purpose of interviewing seniors. One of our February graduates went to work for $7200 per year. When we asked the employer why he will pay him so much, he replied, "Because I made up my mind I was going to sleep nights without worrying about that lad going to work for somebody else."

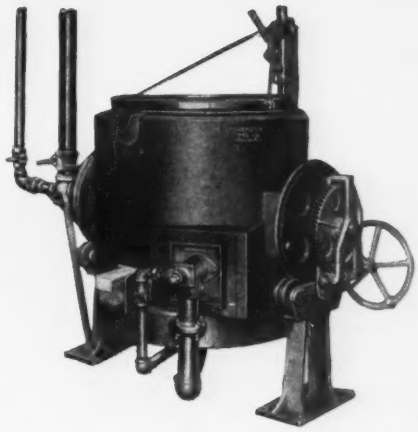
For you foundrymen the problem is further complicated because the foundry industry has never been a "glamor" occupation. The casting of metals is fascinating to you, of course, but you are in the business. The foundry does not capture the imagination of young men as guided missiles capture their imagination, or atomic research, or electronics, or jet engines, or high-frequency circuits or diesel power.

Youth encouragement is vitally important to you foundrymen, first of all because you have to get your share of what few boys there are; and second, because you have to overcome the special advantage of industries which have a considerable "glamor" appeal.

Boys as You Find Them—To me it seems utterly obvious that if we are to encourage boys into the foundries, we shall have to take them as we find them. Perhaps they don't quite conform to our notions of what they ought to be, but our notions are probably obsolete.

There are still a few employers who go out of their way to find fault with the new generation of young men. I wonder if that's good public relations. No foundryman would publicly criticize any of his customers, no matter what he may think of some of them. He has to do business with his customers, and he had better do business with the boys, if he wants his company to survive. And he can't do business with the boys, either, if he abuses them in public.

Let's not forget that every rising generation has been an immense thorn in the side of its elders. I can well remember when I was a lad in my home town of Wisconsin Rapids, Wis. Business associates of my father's used to express their views about the young men of those days, and the views weren't complimentary. I can still see one of those friends of my father's leaning back in his chair on the porch which ran clear across the front of our house, and expound-



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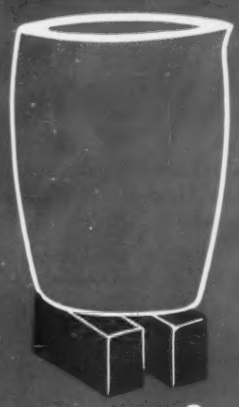

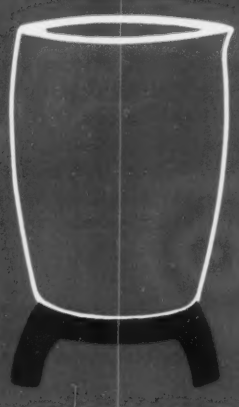

FIRE BRICK?

Insulates crucible bottom, breaks up the continuous flow of combustion gases, causes uneven heating, shortens crucible life.

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Provide uneven seating. The dead air space insulates the bottom of crucible, causes faulty heat distribution, shortens crucible life.

DON'T SAVE PENNIES ON MAKESHIFT BASES AND LOSE DOLLARS ON CRUCIBLES AND FURNACE INEFFICIENCY

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Designed to fit the crucible. Made of the same material as the crucible, Starrbide Bases get heat to the crucible bottom and direct the flow of gases around the crucible for even heating without strains.

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ing the question between puffs of a big cigar.

"The lazy scoundrels won't work," he complained. By "work" he meant digging sewer trench 6 feet deep with pick and shovel in sand or hard clay, under the burning sun, ten hours a day, six days a week, at 15 cents per hour.) He continued. "And they're spoiled, utterly spoiled. They want the world laid at their feet. They are all going to get married in a year or two, and do you know, they think they should have bathrooms and running water in their houses. Can you imagine? When I started out I carried the water up from the river. And what's more, they all expect electric lights right away. What's the world coming to, anyway?"

I am inclined to think that most criticisms of the present generation of young men are just about as reasonable. We had better learn to live with the boys as we find them. The 20 and 25-year-olds are rushing forward and their momentum is tremendous. The smart thing to do is to utilize their magnificent eagerness and energy, rather than to be petulant about some trifling fault we imagine we find here or there.

After working with young men for some years, in the University of Detroit and elsewhere, I am ready to testify that the boys of our day are no worse than the boys of 15 years ago; and possibly just a little better. And I strongly suspect that they are no worse than the boys of 1500 years ago; and possibly just a little better.

What the Lads Expect—Although young men don't change essentially over the generations or the centuries, our present-day young men do possess a few minor characteristics and attitudes which are peculiar to our times. If we expect the young men to work in our foundries, we might well have a look at these characteristics and attitudes.

The boys hope for enough pay to keep up the American standard of living. Every time the chairman or president of one of our great American corporations gives a speech before an assembly of college students, he is sure to tell them about the American heritage of the highest standard of living in the world, which Americans have created by brains, hard work, and the system of free enterprise. And, of course, the boys take all this very seriously.

Now, just what do we mean by the American standard of living? The boys find out quickly enough. They read the magazines and newspapers, even as you and I.

Here is a copy of the current *Time*

magazine. *Time* is not a millionaire's journal; it is read by the millions. What kind of goods, commodities and services are offered for sale to the millions of the common people? Glancing through, I see advertisements for Magnavox television, "You'll agree with the stars"; Pan American Airlines, "You *simply* must go to Puerto Rico"; Packard automobiles, "Ask the man who owns one"; Cook's Imperial Champagne, "Renowned 'round the world"; the California Zephyr, "The most talked about train in the country"; Connsonata, "America's finest electronic organ"; and so on.

Day in and day out our boys read advertisements like these, and week in and week out we preach to them the gospel of the American standard of living. Why shouldn't they demand California vacations, and electronic organs and Packard automobiles as their inherited right because they are American citizens?

They doubtless would, except that they have too much sense.

Of course, our young men take an automobile for granted, and a radio, or possibly a television set. But their demands are quite reasonable. The average lad starting out doesn't even dream about a five or six room house in a good neighborhood. You ought to listen to one of our students or recent graduates brag about the three-room apartment he has found upstairs over a drug store where he and his wife and their little boy or girl can make their home.

Hard Labor—Modern young men don't much like to work with shovels, wheelbarrows and such. Neither, of course, does anybody else. The boys will do hard physical work if they clearly see the need for it, but they will reject hard labor as an exercise or a discipline. They are much too well informed.

They have been listening to Charles Kettering, William Stout, Stuart Chase and other evangelists of the new industrial era. The Ketterings, the Stouts and the Chases have proclaimed the age of the machine. They have explained how applied science and engineering have removed the burdens from the shoulders of men, and have loaded them upon the conveyor, the hoist, the truck and the tractor.

The boys seem to think that the prophets of power aren't fooling.

So when they find themselves in a shop where much hand and back work is still going on, the boys naturally conclude that they have got into an out-moded, obsolete dump of a place, and that they had best get

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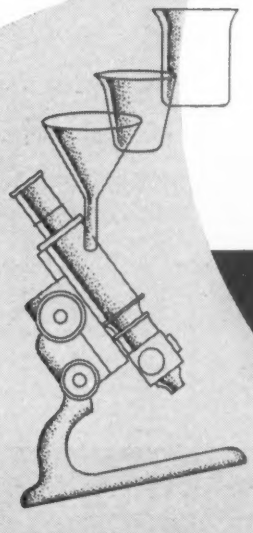

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out of there just as fast as they can.

I am emphatically opposed to physical labor as a breaking-in ritual. I am opposed to the "get the kid's head out of the clouds" sort of thing; or "a few blisters on his hands won't do him any harm; they never hurt me any." You may be sure that blisters are no part of the training program in the radio, chemical, aircraft or electrical equipment industries; or in any other industry which successfully recruits and trains young men. How long would an auto mechanics' school stay in business if the teachers made the boys crank the engines by hand, just because they themselves did it that way 35 or 40 years ago?

I don't say by any means that the hard labor method of training young men is still the fashion in the foundry industry as a whole. But the hard labor method seems to hold over in just enough old shops here and there to give the industry something of a bad name; and most boys will have none of it.

Career Minded—The smart young man of today is not job minded—he's career minded. You do him no favor by letting him work in your plant. He doesn't have to work in your plant. He can go to work anywhere, any time, at almost any rate of pay. And he knows it. Getting money enough to pay for board, room and laundry is no problem; not these days. He can be independent, and he is.

If he does go to work for you, he wants to know where he is going, and he doesn't want to get there too late. Tell him "We'll take you on in our foundry and keep an eye on you. If you work hard and if your record is good, we may be able to find a place for you in our business." That will get you absolutely nowhere. The young man wants to know, "What kind of work am I going to do and how much of it? And if I behave myself, how long will it take me to reach that place in your business, and what kind of a place is it?" If your answers to these questions are anything less than clear and precise, he will pick up his hat and bid you "Good day."

The young man is being perfectly logical. His older brother finished the test course at General Electric exactly two years after getting his degree in electrical engineering. His cousin became an ensign in the Navy exactly four years after he began his college studies. And his brother-in-law was admitted to the bar exactly three and one half years after he entered the school of law.

Many thoughtful foundrymen who

have had long years of experience in preparing young men for their industry are enthusiastic about regular apprenticeship. They contend that the young man should have a chance to sign up for a specified number of weeks or months in melting, molding, metallurgy, welding, inspecting and the like. And some of these experienced foundrymen go so far as to insist upon a formal apprenticeship agreement or indenture, duly sealed, and signed by all concerned.

It is going to be hard enough for you to get boys into your foundries in any case. It will be almost impossible if you have no plan for them. They will sign up for someone else who promises them that they will be radio technicians after two years, or structural draftsmen after three years, or agricultural engineers after four years.

Summary — Now let's summarize. Our job is to encourage boys to get into the foundry industry. To this end, it seems to me that we should keep the following in mind:

1. We shall have to coax them into the shops. They will not come swarming; for one thing, because boys are scarce.

2. We shall have to take them as we find them; and we shall find them not much different from the boys of any other generation, and probably better than we think they are.

3. The boys expect to earn enough to live modestly, and to enjoy a reasonable share of the American standard of living about which we have lectured them all their lives.

4. They understand the significance of modern labor-saving machinery, and they will refuse to perform hard labor as a mere exercise or discipline.

5. The best of them are not interested in jobs as jobs; they are career minded. They may go to work in your foundries if they see opportunities in them, but only if a training program is to be had.

This whole business of encouraging young men to start work in the foundries is of the utmost importance. I am sure that you can't think about it too much, or talk about it too much, or do too much about it. Your older men will retire. You can't run your foundries without men in them, so you have to get in young men, somehow, to take the old men's places.

May I repeat that flourishing organizations always have a system for recruiting and training young men. Continued and expanded effort in AFS, FEF, and your own programs will insure foundry industry prosperity.

Quality

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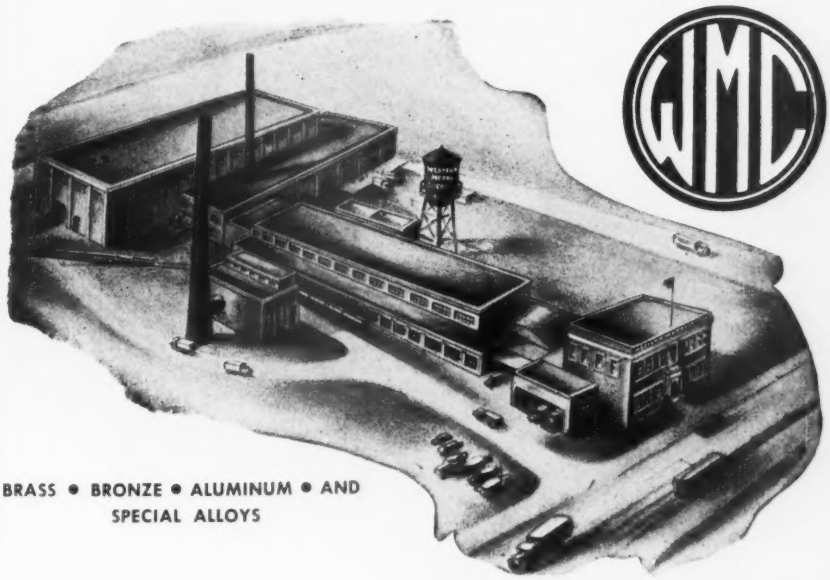

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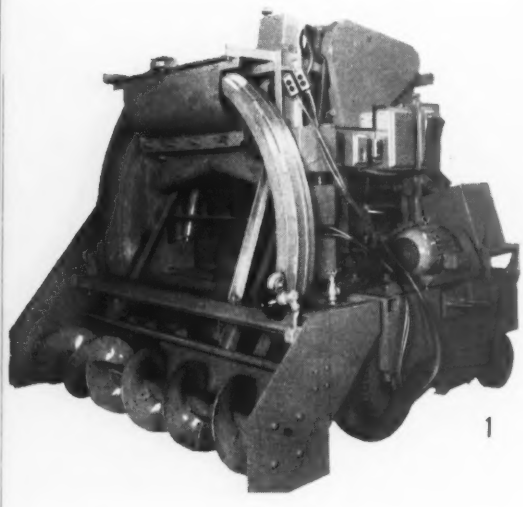
New EQUIPMENT and Supplies

For Additional Information on these Items Use Reply Card—Page 265

(1)—Sand Conditioner: States Engineering Corp., 922 West Berry St., Ft. Wayne 6, Ind.—Sand conditioner is designed for floor preparation of molding sand that is to be piled at the wall or left in windrows. Machine is self-propelled and self-loading with capacity up to 60 tons per hour. Opposed rotating screws develop high thrust pressures which mix and mull the sand while feeding it to a rotating steel anulus, without buckets or pockets, which elevates sand by centrifugal force to a 1200 rpm gyrating screen 3 x 4 ft in area. Screen refuse is deposited in a pivot-mounted box which may be emptied directly into a wheelbarrow. Built-in water spray facilitates moisture additions at the sand mixing point. A gyrating lower deck spreads the remainder of the screened sand over a permanent magnetic drum which removes shot iron and places it in a 5 x 8 x 36-in. drawer. The drum discharges the cleaned sand onto 1200 rpm, 36-in. wide aerators which pulverize small lumps then throw the sand a controlled distance up to 30 ft front or rear.

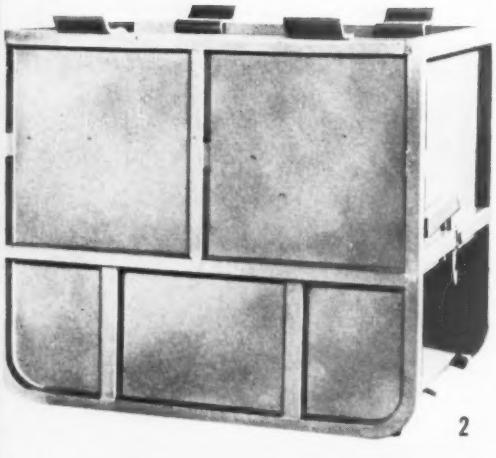
For More Details Circle No. 1—Page 265



1

(2)—Containers: Roura Iron Works Inc., 1401 Woodland Ave., Detroit 11—Drop-bottom containers are constructed of 12-gage steel welded to 2-in. channels. Inside of sides are smooth and unbroken so that contained parts will not be caught. The drop bottom operates by a positive counterweight handle and permits gravity flow of parts to operator's work point when boxes are used to supply grinding wheel or other machine operators with parts in production. Containers also are built for stacking when materials are to be stored. They may be handled by fork truck or overhead lifting equipment. The drop bottom opening is 13 in. high and 31½ in. wide. Size of the box shown is 36 in. wide, 48 in long, and 39 in. high. Capacity is ¾-cu yd; weight is 400 lb. Other sizes can be built to order.

For More Details Circle No. 2—Page 265



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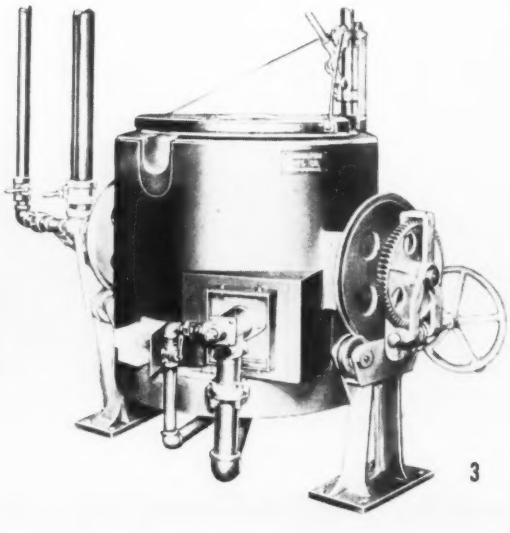
(3)—Melting Furnaces: Johnston Mfg. Co., 2825 East Hennepin Ave., Minneapolis 13 — Melting furnaces are designed for high capacity, rapid melting of all nonferrous metals. They are available for oil or gas, and with tilting or stationary crucibles. Air and fuel are manually controlled, using single valves. Tilting types are said to operate freely and lock in any position. Convenient cover lifting mechanism is operated from the front of the furnace.

For More Details Circle No. 3—Page 265



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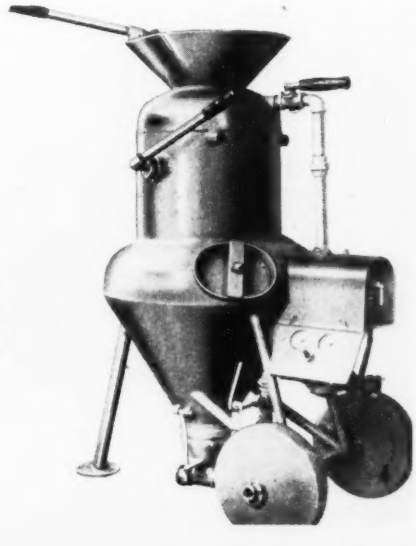
(4)—Refractory Gun: Blastcrete Equipment Co., 11154 Santa Monica Blvd., Los Angeles 25—Machine is designed to blow a variety of materials including cement, sand, lightweight aggregates, refractories, light gravels and other sand or granular or powdery materials. In foundries the machine is useful in blowing refractory materials against a cupola



wall to form a monolithic lining. The operator has complete control of air pressure, material volume and moisture; all adjustments can be regulated while the machine is in operation. Machine can be adjusted to deliver from a few cubic feet of material per hour to 4 cu yd per hr or even more in the case of extremely lightweight aggregates. Characteristics of the applied material can be varied by adjusting air pressure and moisture. Unit also can be used as a sand blasting machine.

For More Details Circle No. 4—Page 265

Bin Level Indicator: Convair Corp., 4156 Library Rd., Pittsburgh —Bin level indicator signals stored material level and provides a method for starting and stopping other equipment in automatic control systems. It consists of a 1/2000-hp motor turning at 5 rpm, connected to a shaft by a torsion spring. At the end of the shaft a four-blade paddle is free to turn as long as material does not touch it. Once touched by material, the paddle stops and the motor keeps on turning until the spring by torsion actuates a limit switch, which kicks out the motor and actuates any other desired equipment. The spring is kept under torsion until the material at the paddle falls away and the paddle turns the spring away from the limit switch and again starts the motor.

For More Details Circle No. 5—Page 265

Face Shield: Mine Safety Appliances Co., Braddock, Thomas, and Meade Sts., Pittsburgh 8—Improved vision, elimination of dead air space, and relief from binding discomforts are among advantages attributed to a new protective face shield. It is supported by adjustable neck and chest straps which provide balanced weight distribution. A soft, pliable leather pad rests on the chest without pressure or binding. Visor can be set at any desired angle, height or distance to provide maximum vision and protection. The chest-mounted shield provides relief from head strain and allows maximum ventilation. Clear visors are available for impact or chemical resistance, and a metal screen visor for hot operations.

For More Details Circle No. 6—Page 265

Acid Goggle: United States Safety Service Co., 1215 McGee, Kansas City 6, Mo.—Acid safety goggle features a bright yellow vinyl frame, the American Standards Association color code for acids. Frame is soft enough to mold in a tight seal to facial contours and has maximum resistance to acids and alkalis. Metal hoods over screen vents offer safe, adequate ventilation. The one-piece lens is made from a special vinyl acid-resistant optical plastic said not to stain or discolor from acid fumes, vapors or splashes. Lens is replaceable. Goggle will fit over personal glasses.

For More Details Circle No. 7—Page 265

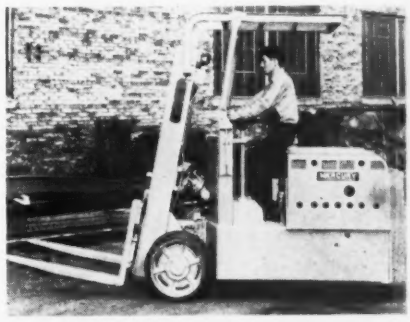
Metallograph: American Optical Co., Southbridge, Mass.—Desk-type metallograph permits microscopic study of metals under polarized light as well as phase and bright field illumination. It is claimed that every operation may be performed while operator sits at the desk. Controls are within easy reach. Final focusing for photography is accomplished quickly, automatically and accurately while examining the specimen through the parfocal visual system. Desk provides ample space for storage and taking notes.

For More Details Circle No. 8—Page 265

Film: Ansco, X-Ray Sales Dept., Binghamton, N. Y.—Complete family of industrial x-ray films, designed to meet the diversified needs of the industrial and scientific radiographer, can be used with low or high kilovolt x-ray exposures or with radium or cobalt gamma radiation, and can be relied upon to give brilliant radiographs of high diagnostic quality, it is claimed.

For More Details Circle No. 9—Page 265

Overhead Guard: Mercury Mfg. Co., 4044 South Halsted St., Chicago 9—Overhead guard for installation on company fork lift trucks has an overall installed height of 95 in. When necessary, this height may be reduced to 91 in. Guard is attached pivotally to the lifting mast and also pivotally supported from the lift truck dash. This method of securing permits the guard to remain horizontal, regardless of the degree of lifting mast tilt.



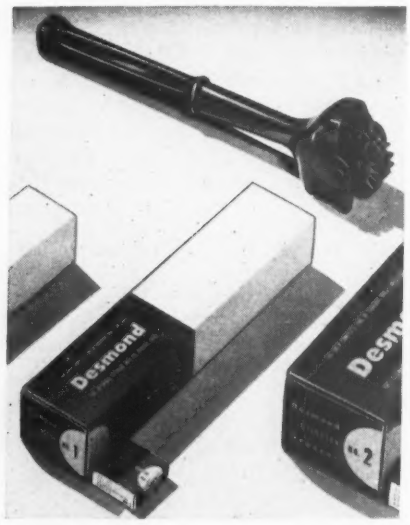
For More Details Circle No. 10—Page 265

Radiation Meter: Tracerlab Inc., 130 High St., Boston, Mass.— Combination radiation survey meter for plant Civil Defense protection and the monitoring of foundry areas where industrial radiography is being carried out has five scale ranges of 5, 50 and 500 milliroentgens per hour and 5 and 50 Roentgens per hour. These scales are arranged in order of increasing sensitivity; have different colors, and are automatically changed when the scale is switched, so that only the selected scale is visible. Instrument is submersion and shock proof and is designed to operate under severe temperature and humidity conditions. Other features include a 4-in. rectangular meter, accuracy of ±15 per cent of indicated dosage reading anywhere on scale, and built-in checking source for determining proper instrument functioning.

For More Details Circle No. 11—Page 265

Casting Inspection: Met-L-Chek Co., 121 North Prairie Ave., Hawthorne, Calif.—Testing process for detecting cracks, pores, and cold shuts was developed for use on ferrous, nonferrous, ceramic, glass, and thermosetting plastic parts. The process is said to permit mass visual inspection of parts under normal shop conditions. In practice, parts are dipped in a highly penetrant red dye solution. The dye penetrates any cracks or pores within 3 minutes. Surplus dye is washed away with water. Surface tension of water prevents it from penetrating microscopic cracks, therefore only the dye in the cracks remains. Parts are dipped in a white

specify genuine



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Cutter bushings of hardened steel, which permit cutters to revolve with minimum friction and heat from radial loads.

Cutter side washers of hardened steel, to act as bearings and absorb side thrust wear.

Cutter pins of special hardened steel, accurately made and easily replaceable.

Specify Desmond —the only complete line of grinding wheel dressers, for all requirements—stocked and distributed by selected Desmond Industrial Distributors . . . The Desmond-Stephan Mfg. Co., Urbana, Ohio.

the only complete line of grinding wheel dressers & cutters

Desmond

developer solution. This dries quickly, leaving a white coating which sucks the dye out of the cracks the same as a blotter sucks up ink. The dye spreads out through blotting action, leaving a vivid stain many times wider than the flaw, and therefore, visible to the naked eye.

For More Details Circle No. 12—Page 265

Vacuum Unit: Hild Floor Machine Co., 740 West Washington Blvd., Chicago 6—Portable vacuum unit is made with a 55-gal tank which holds 5 bushels of dry dirt or 40 gal of recovered liquid. Unit is mounted on a heavy steel dolly fitted with a hinged handle and three ball bearing casters. A 2-in., quick-opening gate valve permits the liquid contents of the tank to be emptied into a drain or gutter. The 20-ft vacuum hose is wire reinforced for extra strength. The unit is designed to pick up either liquid or dry dirt without adjustment or change of parts.

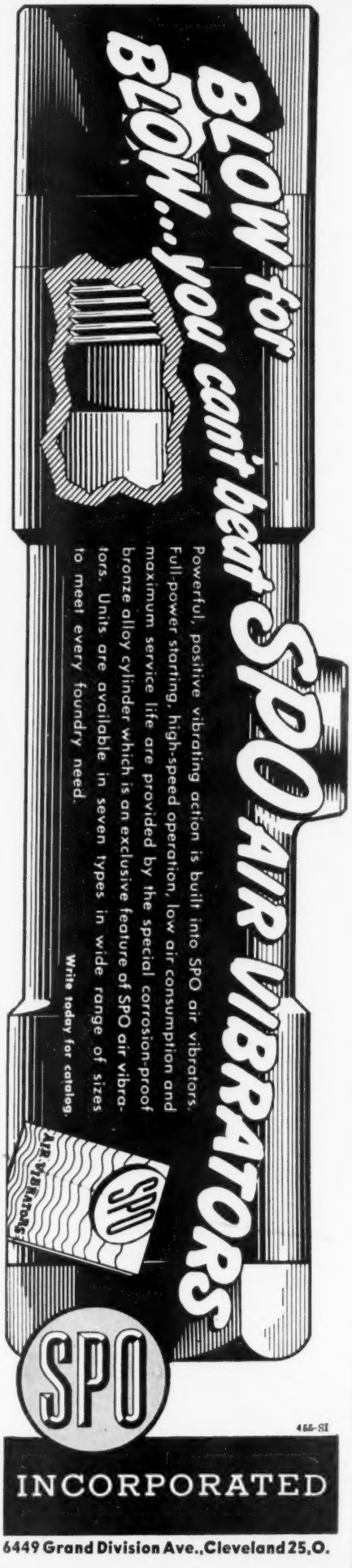
For More Details Circle No. 13—Page 265

Hand Cleaner: Khemo-Clean Co., 3265 South Ninth East St., Dept. C11, Salt Lake City, Utah—Hand cleaner does not contain gasoline, ammonia, petroleum, ether, nor harsh abrasives. A spoonful is rubbed briskly on the hands until it liquefies, disperses, penetrates, and lifts the embedded dirt and grime off the skin. The dissolved matter can be rinsed off with water or wiped off with a rag or paper towel.

For More Details Circle No. 14—Page 265

Belting: Main Belting Co., 1241 Carpenter St., Philadelphia 47—Conveyor belt is designed for applications using infra-red and radiant heat ovens for rapid drying operations. Constant temperatures at upwards of 600°F are said to be well within the

(*Continued on page* 268)


BLOW for BLOW... you can't beat SPO AIR VIBRATORS
Powerful, positive vibrating action is built into SPO air vibrators. Full-power starting, high-speed operation, low air consumption and maximum service life are provided by the special corrosion-proof bronze alloy cylinder which is an exclusive feature of SPO air vibrators. Units are available in seven types in wide range of sizes to meet every foundry need.
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AVAILABLE FOR THE ASKING—This reader-service is designed to provide foundrymen with "idea" and reference material. Listings are selected from company product literature and reprints of special FOUNDRY editorial articles.

50. Horizontal Screens

Simplicity Engineering Co.—"Simplicity Horizontal Screens for High Volume Capacity—Low Headroom Requirements" is title of 4-page folder which briefly describes and illustrates single, double and triple deck horizontal screens for coal and ore dewatering and separation processes. Send for it now!

51. Dust Buster

American Air Filter Co.—Though it's named the Roto-Clone Type D dynamic precipitator, it really does a job of exhausting and dust separating. There are 13 sizes with capacities from 100 to 15,000 cfm. For all the dope, get 20-page dust control bulletin No. 272-A.

52. Tractor Shovels

Frank G. Hough Co.—No need to "hough or pough" if you use a Hough Payloader tractor shovel in your bulk handling. Fifty on-the-job photos are found in 12-page form 205. Performance data and specifications of various models are included.

53. Clamshell Buckets

George Haiss Mfg. Co.—When the teeth of Multi-Sheave or Power-Wheel rehandling buckets sink down into bulk material, they will come up with the goods. Eight-page illustrated bulletin H-850 gives you all the info on the Haiss line of clamshell buckets. Get up off yours and get this.

54. Abrasive Wheels & Disks

Bay State Abrasive Products Co.—Increased production costs can be kept at bay through use of Bayflex, DuraCut and Saf-T-Cut reinforced resinoid products, described and illustrated in 24-page brochure. Reinforced disk-wheels, straight wheels, mounted wheels and points, abrasive disks and other products are covered.

55. Metal Casting Plaster

United States Gypsum Co.—Gad, sir, you say that Hydroperm permeable metal casting plaster for nonferrous casting produces a smooth medium for casting many n-f metals and alloys? And it is described in illustrated loose-leaf bulletin IGL-35. Sounds good, I'll send for it post haste.

56. Power Shovel-Scoop

Stearns Magnetic Inc.—Something new for unloading bulk materials from R.R. cars is the magnetic clutch-controlled power shovel, actually a scoop on a cable which is controlled from the scoop handle by a dead-man switch. All the facts and figgers, plus operating data and installations, are shown in 4-page illustrated bulletin 250 A.

57. Mechanical Finishes

Roto-Finish Co.—Zounds, but this sounds good. Here is a 16-page well illustrated booklet "Precision Finishes Mechanically with Roto-Finish" which details grinding, deburring, descaling, polishing, Britehoning and coloring applications of process. How it works and equipment used is covered. Good? Yes!

58. Hand Planer & Joiner

Oliver Machinery Co.—The "plane" facts about the No. 144 ball bearing Hand planer and jointer are yours if you send for illustrated 4-page folder 1445009. Model incorporates latest improved design and has table measuring 60 in. overall.

59. Sand Mix-Mullers

National Engineering Co.—In mulling over your sand problems you may find it advantageous to read 6-page bulletin 511. It outlines features of the 2F and 3F Simpson intensive mix-mullers. Operating principle and specifications are given, and size and output characteristics are tabulated.

60. Hoist Away

Chisholm-Moore Hoist Corp.—Speeding industrial production with CM Meteor heavy-duty electric hoists is theme of 24-page illustrated bulletin 142-D. In addition to describing wide range of sizes and types of hoists, this guide covers accessories which aid in powering and using them for all types of materials handling operations.

Additional Information?

For additional information on any of the items described under "New Equipment and Supplies," "Trade Publications" or "Ideas for Foundrymen" in this issue—simply circle corresponding item numbers on one of these cards

6-52

FOUNDRY
Penton Building, Cleveland 13, Ohio

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61. Single Line Buckets

Wellman Engineering Co.—Williams type Hook-On single line buckets are designed to provide clamshell bucket service at any crane hook where suitable head room and hoist capacity is available. So says 12-page brochure P3-116 which describes these buckets, offers tabulated specification on open and closed head heavy and extra heavy duty models.

62. Storing Abrasives

Armour & Co.—Proper control of relative humidity will prevent the deterioration of coated abrasive materials. "How to Store Coated Abrasives" is a handy guide on this subject. There's a lot more life in properly stored abrasives than in those that just lay on a shelf or rest in a drawer.

63. Better Iron Castings

Cleveland Flux Co.—Scored brick form Cornell iron cupola flux is so easy to use that it's a pleasure to add just the right amount of flux to each charge. The why's, how's and wherefore's are told in 6-page illustrated bulletin 46-B. Your copy is waiting.

64. Sand Reclaiming Pays

Nichols Engineering & Research Corp.—8-page illustrated bulletin 222 tells you exactly how you can save hundreds of dollars by reclamation of spent foundry sand with high or low temperature reclamation systems. All substances that might interfere with rebonding of sand and its reuse are removed economically.

65. Die Casting Machines

Kux Machine Co.—"Kux Die Casting Machines" is title of comprehensive 24-page catalog that gives complete information on air, hydraulic and convertible models of die casting machines for producing various sizes of castings from zinc, lead, tin, aluminum, brass or magnesium. Specifications are given and representative users are listed.

66. Durable Pattern Coating

McDougall-Butler Co.—Oils, water, waxes, kerosene and gasoline can't hurt your patterns when they are coated with improved Hardlac pattern coating. This finish is available in standard colors. Full details are given in 4-page illustrated bulletin.

67. Dumping Buckets

Penn Iron Works Inc.—There's a size and type of dumping bucket for every need. You'll find all the dope on them in 40-page illustrated catalog. Whether it's sand, coke, scrap, castings or some other foundry product, Penn buckets will speed handling.

68. Electric Power Drives

Sterling Electric Motors, Inc.—Every foundry uses one or more of these—variable drives, geared motors and constant speed motors in dripproof, splashproof, totally-enclosed and pipe-ventilated designs. You'll find answers to any questions you have on them in 20-page illustrated catalog "Sterling Electric Power Drives."

69. Vibrators & Accessories

New Haven Vibrator Co.—Anything you want in the line of Branford attaching vibrators for molding machines, hoppers and bins, hose fittings, valves,line oiling devices, sprayers, flask rappers and shakeout tables is cataloged in 48-page illustrated plastic-bound booklet G. Instructions on installation and maintenance of heavy duty vibrators is featured and, price list as of Jan. 22, 1951 is attached.

70. Clean, Dry Air

Logan Engineering Co.—Did you know that 92 per cent of all oil, moisture and dirt can be removed from compressed gas and air lines with the Aridifier. How this simple device works, selecting the right size and typical uses are related in 8-page illustrated bulletin 252. This booklet means dollars in your plant's pockets.

71. Industrial Power Trucks

Mercury Mfg. Co.—Thumbnail descriptions and illustrations of several types and sizes of industrial power fork trucks and tractors and of trailers for materials handling are contained in 4-page illustrated bulletin No. 301.

IMPORTANT READING FOR FOUNDRYMEN
We have a limited quantity of the following reprints which we can furnish while they last.

72. Metal Solidification

Straight from the Naval Research Laboratory comes this FOUNDRY reprint on "Solidification of Metals" by H. F. Bishop and W. S. Pellini. Published for the first time is the concept of solidification Thickness-Time-Transformation Mode (TTT) curves for various metals. Valuable data this—get it.

73. An Apprentice Program

Program for training and development of all-around molders and coremakers is described in detail by Pat Dwyer, our Engineering Editor, in his article "Develops Foundry Apprentice Program." Reprint gives facts on Fulton Foundry & Machine Co. program and reproduces some of forms used.

74. Unmechanized Modernization

From the 1951 International Foundry Congress in Brussels sprouted this article "Modernization Without Mechanization" published in FOUNDRY and reprinted that you might lamp it. Your eyes will be opened when you read about this completely modern foundry employing only limited mechanization.

75. Maintaining, Selecting Flasks

Valuable information, yes, lots of it, is contained in this reprint from FOUNDRY entitled "How To Select and Maintain Flasks." All of the pertinent considerations are outlined and many of the features are illustrated.

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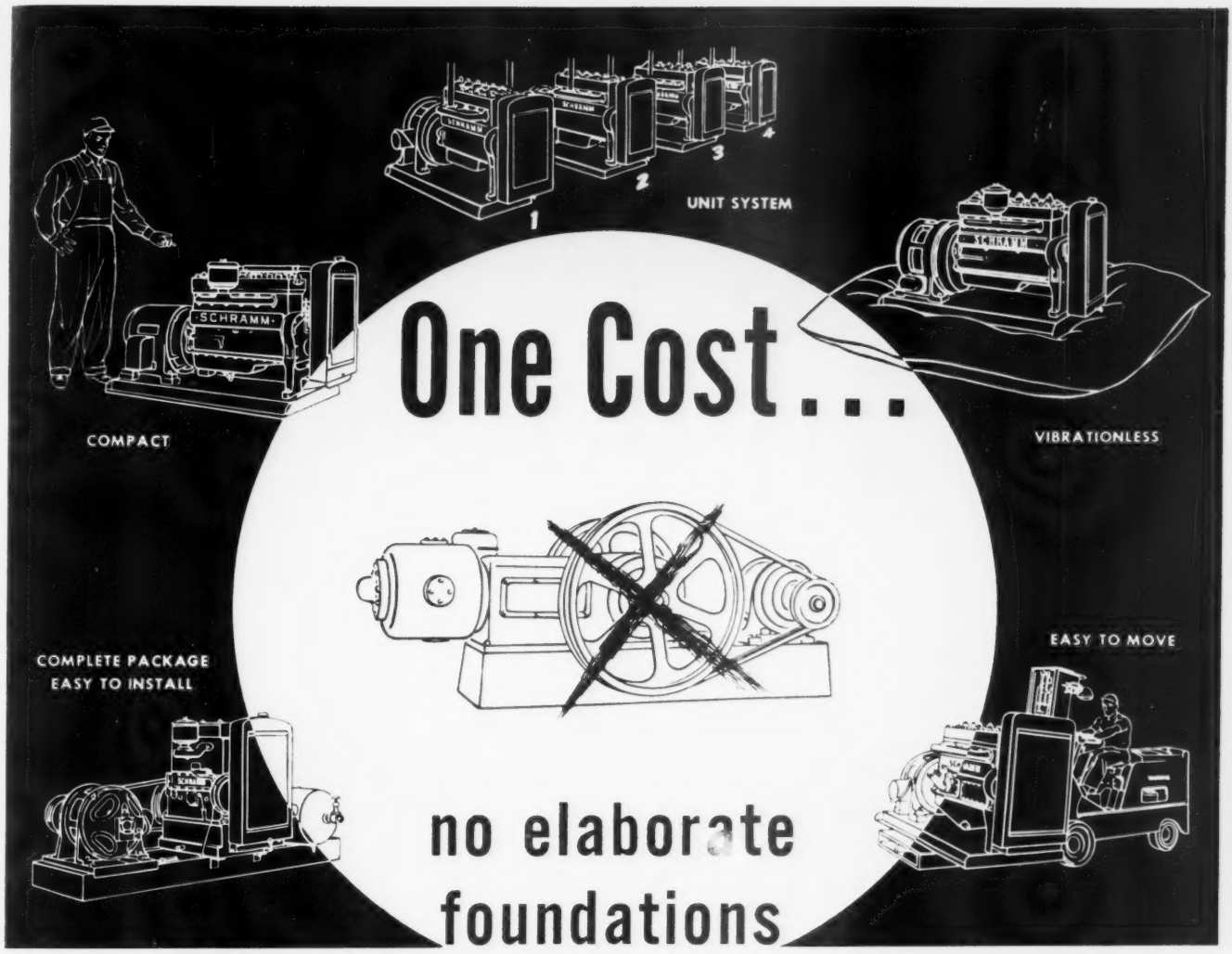

WHEN INSTALLING THE MODERN

SCHRAMM AIR COMPRESSORS

Complete assembled SCHRAMM units are furnished with compressor and motor mounted on a substantial steel base, which can serve as a foundation. No deep pit foundation or time and expense consuming "built-up" concrete foundation is necessary.

En-Bloc construction is one of the many contributing factors to this feature in the SCHRAMM Modern Stationary Compressor. The single block casting contains all of the cylinders, the main crank shaft bearing supports, camshaft bearing supports and the complete lubricating system.

SCHRAMM Compressors are built for 24-hour continuous service, in sizes ranging from ⅓ to 100 horsepower.

Write for booklet C-50B for further information.

SCHRAMM INC.

The Compressor People

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Please send Free Booklet C-50 B on installing Stationary Air Compressors.

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question:

How can you

SAVE MONEY

IN CASTING

all types of

ALUMINUM ALLOYS?

answer:

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COVERAL

for these important reasons:

1. Produces metal-free dross.
2. Prevents oxidation.
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FOSECO COVERALS are the most efficient covering compounds yet produced. Nearly a quarter century of "know how" and experience help you obtain BETTER aluminum castings at LOWER cost. You save metal—have fewer rejections.

There's a FOSECO COVERAL made for every type aluminum casting. Tell us the alloy you melt, type furnace and pouring temperature—we will be glad to recommend the proper FOSECO COVERAL for your requirements.

WRITE TODAY—ASK ABOUT OUR "NO RISK" TEST

FOUNDRY SERVICES, Inc.

280 Madison Ave., Dept. F
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(*Continued from page 264*)

range of this canvas-asbestos belt. Feature of the belt is insulation between the plies of asbestos cloth and between the asbestos and the duck. This insulation keeps excessive heat away from the carcass. Two or more plies of asbestos are stitched with asbestos thread on the conveying side, while the carcass is high-strength cotton duck in either of two weights—37½ or 39 oz.

For More Details Circle No. 15—Page 265

Refractory Gun: Construction Machinery Sales Co., Waterloo, Iowa—Machine pneumatically "shoots" refractory materials used in lining cupolas and other furnaces as well as other fine aggregates, including cement. Designed as an independent machine to be used with a separate

air compressor, the machine features a moving air lock that provides continuous feeding. In operation, granular refractory with either fire clay or other binder is mixed and placed in a hopper. From there it is fed automatically and continuously into a compressed air stream and carried through a hose which may vary in length from 50 to several hundred feet. At the applying end of the hose is a nozzle incorporating a water ring fed through a separate hose and valve. Eight small holes in the ring direct jets of water into the stream of refractory and binder as it passes through at high velocity. The mixture is directed against walls of the furnace to lay up a monolithic lining.

For More Details Circle No. 16—Page 265

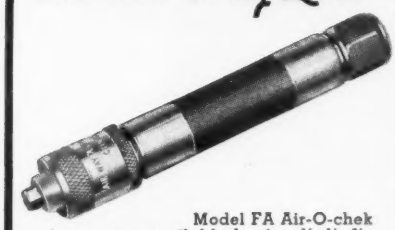
Roof Ventilator: Tripar Products Inc., 14641 West Eleven Mile Rd., Royal Oak, Mich.—Roof type ventilator moves air at 5000 to 45,000 cfm, depending upon size. When the fan is started, mechanically actuated louvers open fully and automatically. Power to open louvers is provided by the fan drive motor through simple

is cheap in low pressures. COMPRESSED AIR comes high —Leaks are costly.

SAVE WITH AIR-O-CHEK-

The airgun that's tight as a drum and lasts til kingdom come.

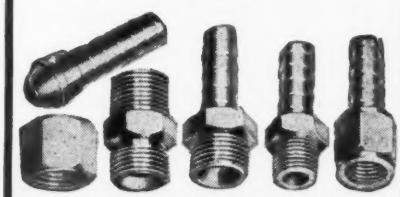
The Air-Way Line—



Model FA Air-O-chek airguns are available having ⅛ ¼ ⅜ ½" standard pipe threaded inlet.

Model A Air-O-chek airguns are available having integral serrated hose shank for 3/16 ¼ 5/16 ⅜ ½" ID air hose.

Air Line Units—Any length of hose coupled with model A Air-O-chek airgun and pipe threaded fitting. Fittings in any quantity.



Check √ and double check √√ use AIR-O-CHEK. Tens of thousands do, why not you.

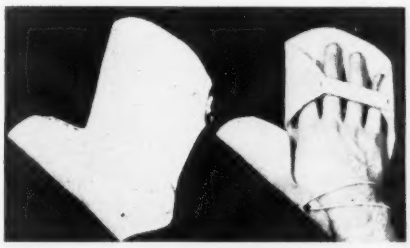
Write for details.

AIR-WAY PUMP & EQUIP. CO.
1058 N. Kilbourn Ave., Chicago 51, Ill.

lever-clutch mechanism. Immediately when fan is stopped, louvers close positively and lock in closed position until unit is turned on again. Standard sizes range from 24 to 48 in. Special sizes, top or bottom motor mountings or belt-driven units for use in corrosive atmospheres, can be furnished.

For More Details Circle No. 17—Page 265

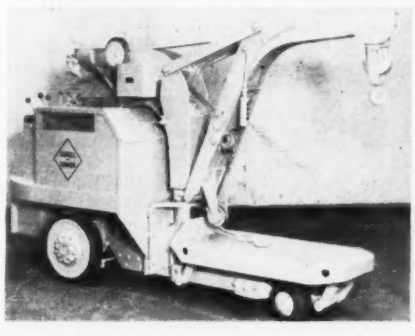
Hand Pads: General Scientific Equipment Co., 27th & Huntington Sts., Philadelphia 32—Horsehide hand



pads, adjustable to any size, have new adjustable tie string to keep them on and make removal easy. They are said to offer maximum protection and comfort, and are intended for handling brick, sharp edged castings, scrap, and any other rough or jagged items.

For More Details Circle No. 18—Page 265

Platform Truck: Elwell - Parker Electric Co., 4205 St. Clair Ave., Cleveland 3—Combination low-lift platform truck and crane has the following features: A 4000-lb capacity, self-loading platform designed to lift and transport skids; a powered winch for pulling heavy loads on or off the platform, and a boom which swivels 180 degrees, permitting hoisting loads up to 2000 lb. Power is supplied by battery or gas-electric unit. Winch, platform and hook can be controlled from both the operator's



position and the load end, using the remote control switch located on the boom. Two-wheel drive, four-wheel steer is provided. Although the truck illustrated is equipped with a fixed boom height, models also are available with moveable booms. Overall truck length is 134 in.; width 41 in., and height 72 in. Maximum hook height is 57 in. with an outreach of

Solve your shower problem

WITH MULTI-PERSON

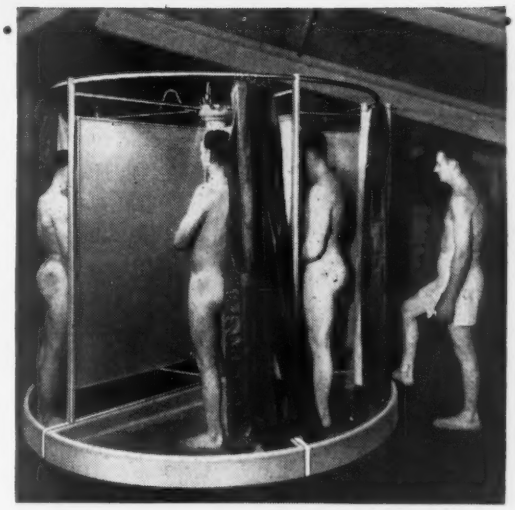
BRADLEYS

★ Cut plumbing connections 80%

★ Lower water consumption 70%

★ Provide added shower facilities in less space

★ Install quickly on any kind of floor —including wood



Five-stall shower with receptors. Also made in 3-stall model.

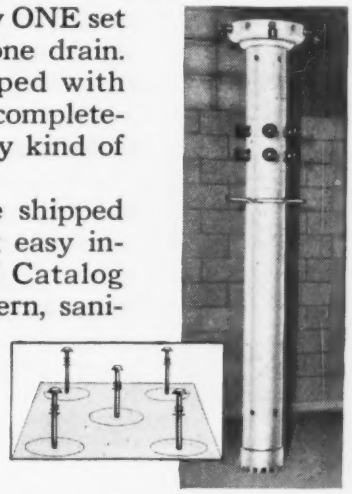
Economical Group Showers Meet All Modern Washroom Requirements

If you are building, modernizing, or adding to your present facilities, Bradley Multi-Stall Showers will answer your shower problems.

Bradleys are available in 3-stall semi-circular units for against the wall installation and in 5-stall circular units. Each Bradley 5-stall unit performs the service of FIVE conventional single-stall showers, yet requires only ONE set of hot and cold water piping and one drain.

Bradley Showers can be equipped with water receptors making each shower completely self contained. Installation on any kind of floor including wood.

Bradley Multi-Stall Showers are shipped partially assembled ready for quick easy installation. Write for your copy of Catalog 4701CS illustrating the many modern, sanitary, money saving features of Multi - Stalls. BRADLEY WASHFOUNTAIN CO., 2217 W. Michigan St., Milwaukee 1, Wisconsin.



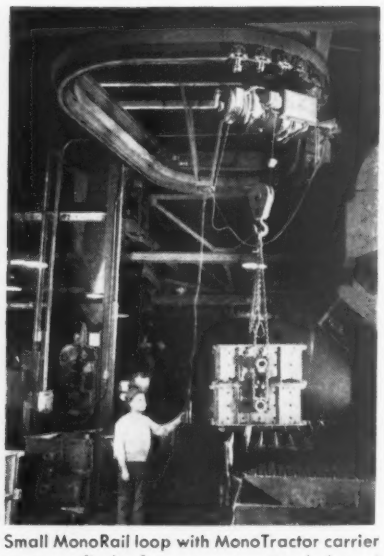
BRADLEY multi-stall showers

Distributed through Plumbing Wholesalers

Bradley Column Showers, like Multi-Stalls, are also ideal for many locations such as factories, mines, camps, schools, field houses, and institutions. Column Showers are shipped complete ready for installation with drain fittings, sprayheads, soap trays and mixing chamber for temperature control.

Hand-pushed American MonoRail Cranes with air hoists serve the molding turntable where cores are set, molds closed and placed on an 82-car conveyor loop for transfer to pouring area.

Two MonoTractor driven ladle carriers move around the MonoRail loop from cupola to conveyor where carrier travel is synchronized for careful pouring.



Small MonoRail loop with MonoTractor carrier removes flasks from conveyor to shake-out and return.

Modern Foundry Methods

WITH

AMERICAN MONORAIL

At the Chapman Valve Mfg. Co., Indian Orchard, Mass., a compact, 82-car conveyor loop is serviced by an American MonoRail system consisting of hand-pushed cranes and Mono-Tractor driven carriers. Both time and labor are saved through the mechanized transfer of both flasks and ladles.

Many other handling operations in the foundry can be efficiently and carefully performed with American MonoRail systems. Let an experienced engineer show you what has been done. Write for Bulletin C-1 offering hundreds of application pictures.

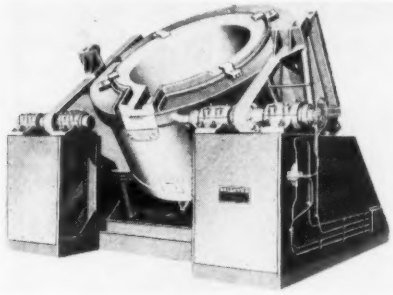
THE AMERICAN MONORAIL COMPANY

13104 ATHENS AVENUE ● CLEVELAND 7, OHIO

61 in. Platform height is 10 7/16-in. with a lift of 5¾-in. Platform is 26½ x 53 in.

For More Details Circle No. 19—Page 265

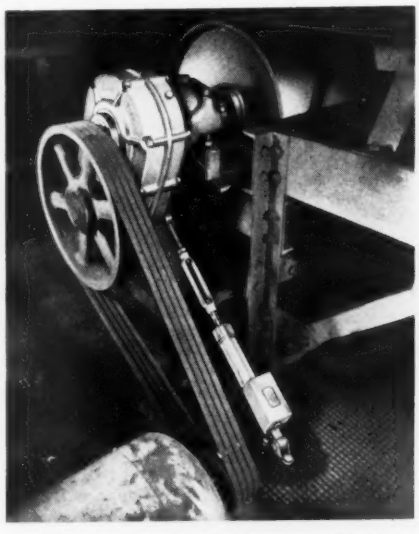
Melting Furnace: Bellevue Industrial Furnace Co., 2620 Crane Ave., Detroit 14—Melting pot furnace of 25,000 lb capacity is designed for melting Kirksite metal. Furnace and



pot are tilted by hydraulic cylinders at adjustable speeds. Return stroke is double control—a cam flow adjustment to allow a limited rapid return to stop the pouring of metal and a flow control to permit remainder of return stroke to cushion furnace into return position. Metal is heated by burners mounted below the pot, firing tangentially to the internal lining. Unit may be built for gas, oil, or gas-oil combination firing. Venting out the hot gases takes place between the pot and the refractory ring at top of furnace. Pot is 76 in. in diam by 37 in. deep. The large pot opening permits charging large pieces of metal, reducing extra labor in cutting pieces to smaller size.

For More Details Circle No. 20—Page 265

Speed Reducer: Dodge Mfg. Corp., Mishawaka, Ind.—Double-reduction shaft-mounted speed reducer has capacity to 43 hp and output

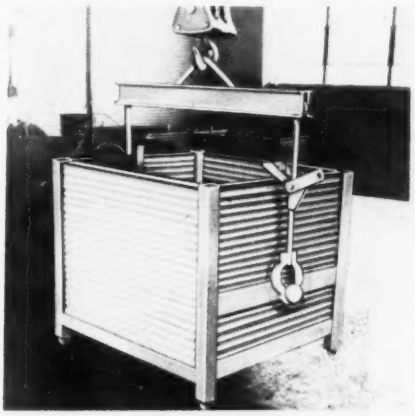


speeds from 12 to 110 rpm. Unit is anchored with a torque arm which fastens to any fixed object. A turnbuckle enables fast, easy adjustment

of belt tension. Company offers single and double reduction speed reducers with capacities from 1 to 43 hp and output speeds from 12 to 330 rpm. The new reducer is shown here mounted on the shaft of the solid steel head pulley of a sand belt conveyor. The anchoring arm is equipped with an overload release which loosens the belts, cuts off the power, and gives an alarm in the event of an overload.

For More Details Circle No. 21—Page 265

Scrap Box: Equipment Mfg. Inc., 21550 Hoover Rd., Detroit 5—Scrap carrying unit consists of a corrugated steel box and yoke for handling by crane or hoist. Eyes of the yoke slip over pivot blocks on the sides of the box for lifting and carrying. Trip fingers on the yoke drop over a bar welded on the box to prevent it from



tipping. Because of the low position of the pivot blocks and low center of gravity, the box automatically turns over and discharges the load when holding fingers are tripped. Standard box size is 36 x 42 in. and 30 in. deep with capacity of 32 cu ft. Other sizes are available. Nesting caps on the feet permit stacking the boxes, full or empty. Casters may be specified if desired.

For More Details Circle No. 22—Page 265

Pyrometer Converter: Pyrometer Service Co., 348 River Rd., North Arlington, N. J.—Kit contains all the parts necessary to convert a mechanical pyrometer to full electronic operation. The converter will fit most makes of pyrometers and can be used in strip chart and round chart recorders and indicators. Converted unit is said to give stable, dependable performace. Installation is simple, it is claimed, requiring only a screwdriver, pliers and soldering iron.

For More Details Circle No. 23—Page 265

Badge Maker: Anderson & Sons Inc., Westfield, Mass.—Kit for producing identification badges in 90 seconds consists of a Polaroid Land camera, necessary lights, photograph

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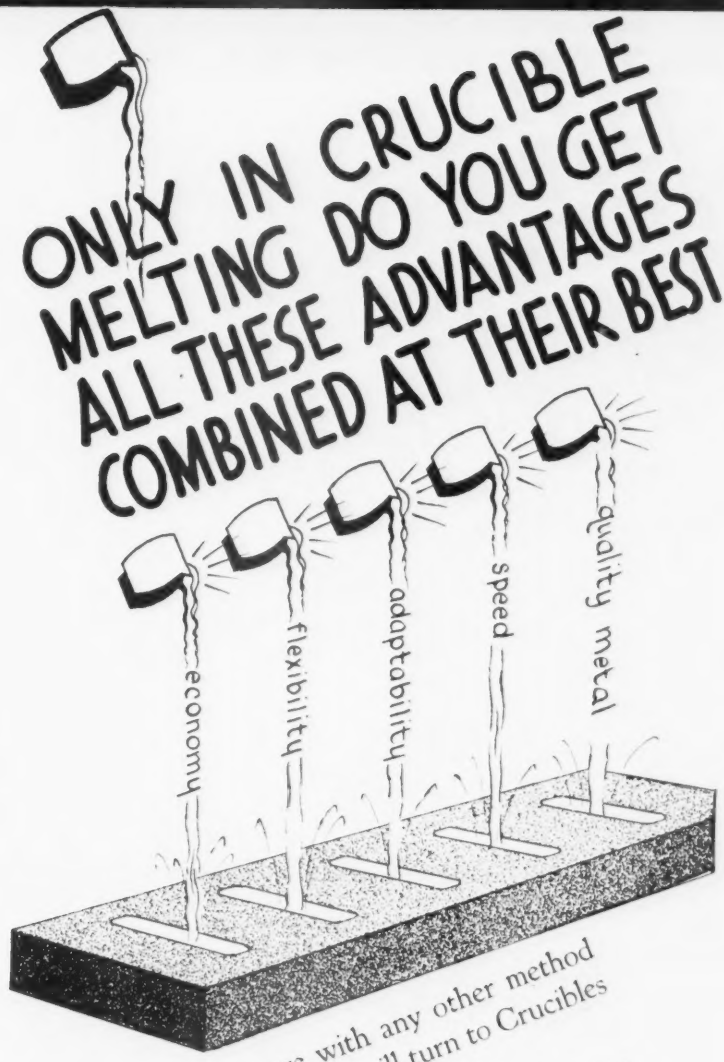

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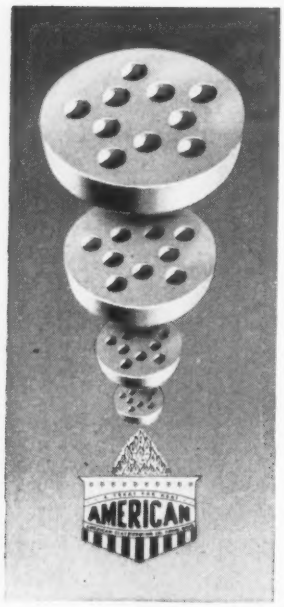

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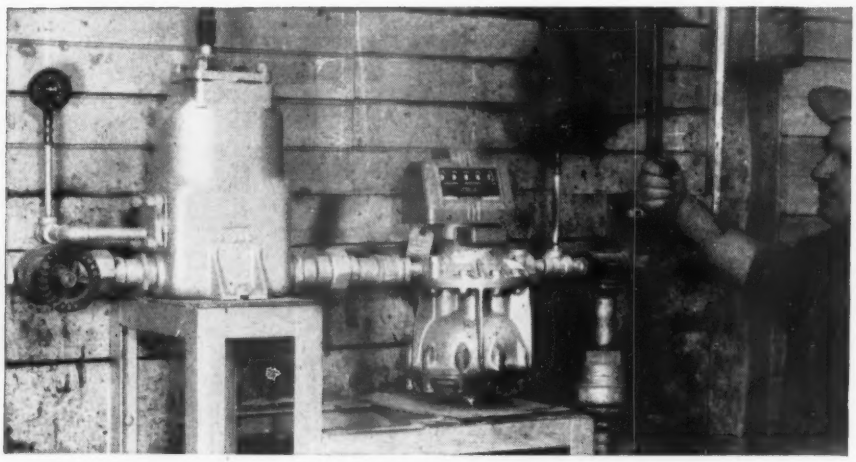

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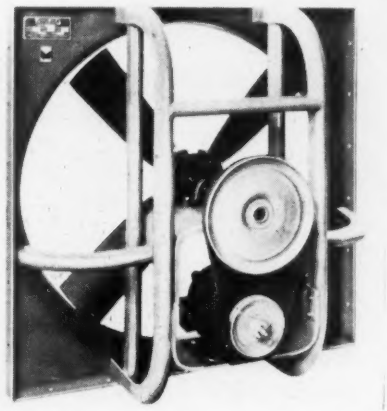
For More Details Circle No. 24—Page 265

Fans: Chelsea Fan & Blower Co., 639 South Ave., Plainfield, N. J.—Belt-driven fans for industrial applications where large volume of air is required under static pressure are equipped with nonoverloading cast aluminum airfoil type propellers. Fans are completely ball bearing equipped and motors are totally enclosed. Units



are available in sizes from 24 to 48 in. and air deliveries from 5000 to 28,000 cfm.

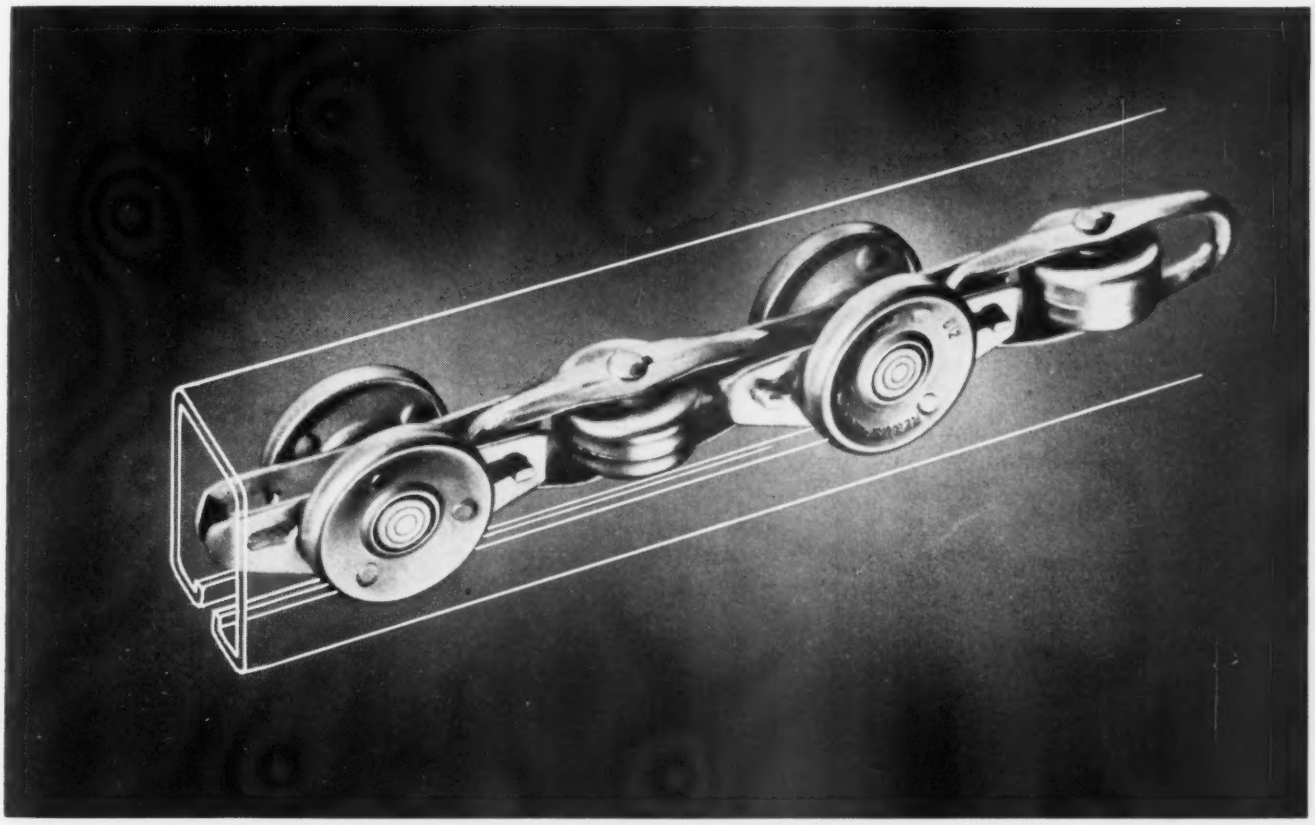
For More Details Circle No. 25—Page 265

Perlite: Cleveland Gypsum Co., 1276 West Third St., Cleveland 13—Foundry sand additive is specially processed from perlite, a volcanic rock. When added to facing sands it is said to permit good gas elimination with hard ramming, low moisture content, and improved flowability. Casting defects commonly resulting from hard ramming or high moisture content are said to be reduced. Linear expansion of perlite ore is less than that of sand, and its use in proper proportions helps avoid rat tails, buckles and other defects due to expansion, it is claimed. Because of its low heat conductivity the material is useful in the insulation of risers.

For More Details Circle No. 26—Page 265

Roof Coating: Paramount Industrial Products Co., University Center Station, Cleveland 6—Asbestos-aluminum coating for roofs is reputed to lower under-roof temperatures 10

(*Continued on page* 274)



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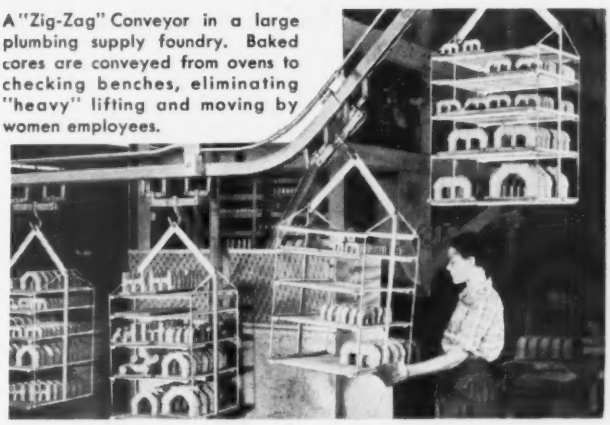
Continuous Power Conveyor

"Zig-Zag" Continuous Power Conveyor is a continuous motor-driven chain that operates *overhead* to give you far greater efficiency and economy in core-handling. The specially constructed chain runs in a steel tube-like track. It's designed to carry unit loads up to 125 pounds at speeds from 1 inch to 60 feet per minute. "Zig-Zag" can be installed in any plant to conform to space limitations, and it may be quickly and easily adapted to plant alterations. "Zig-Zag" requires a minimum of handling, utilizes "dead" space to release valuable floor area and valuable hands for other jobs.



A "Zig-Zag" Conveyor in a large plumbing supply foundry. Baked cores are conveyed from ovens to checking benches, eliminating "heavy" lifting and moving by women employees.

All moving parts are enclosed for extra safety; and the low original costs and low power factor save you money.

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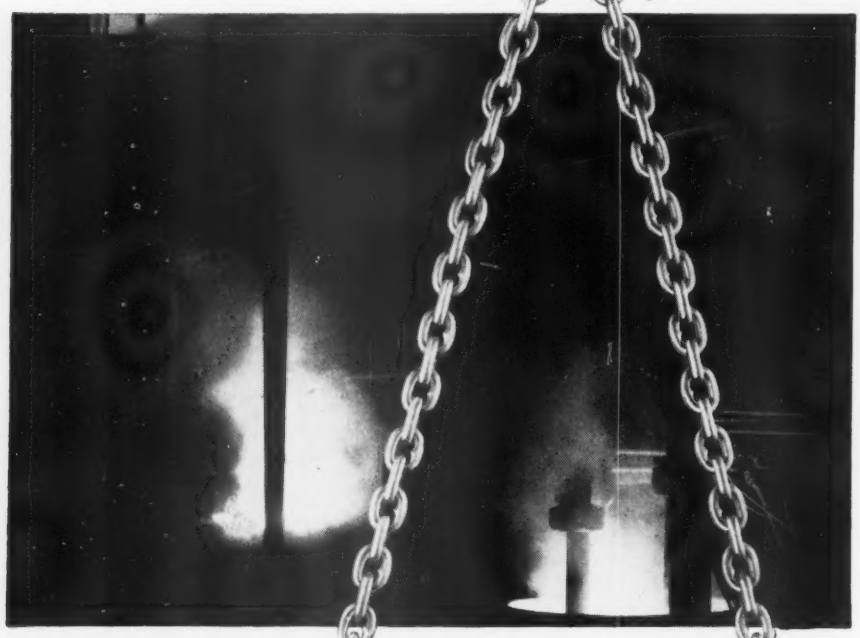

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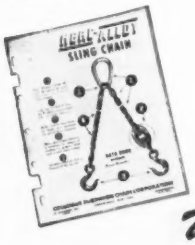

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(Continued from page 272)

to 20 degrees. The coating reflects sun rays, which helps reduce the temperature and also retards the drying of waterproofing oils, thus prolonging roof life, it is claimed. Made of asphalt, asbestos, and waterproofing oils pigmented with aluminum, the material is said to withstand extremes of heat and cold without cracking or wrinkling, and is resistant to industrial vapors, gases and fumes. It can be applied by brushing or spraying.

For More Details Circle No. 27—Page 265

Big Hopper: Yale & Towne Mfg. Co., Philadelphia Division, 11000 Roosevelt Blvd., Philadelphia 15—New

4000-lb capacity high lift platform truck with an 80 cu ft end dump hopper is designed for handling bulky loads of loose material. Hopper can be tilted downward to scoop up loads, or it can be loaded from overhead. Truck is a standard 4000-lb electric high lift platform truck with a specially shortened platform to accomodate the hopper. The platform elevating mechanism is used to dump the hopper.

For More Details Circle No. 28—Page 265

Level Indicators: Stephens-Adamson Mfg. Co., 100 Ridgeway Ave., Aurora, Ill.—Explosion-proof bin level indicator is designed for operation in hazardous areas where explosive vapors and dust occur. It is approved by the Underwriter's Laboratory for various classifications, including vapors and dust from such materials as ethyl ether, gasoline, alcohol, acetone, coal, grain, and flour. A heavy duty model also has been developed for use where stored materials have lump sizes exceeding ¾-in. Indicators are designed so that a rising or falling level of material in bins deflects a pendant float actuating a micro switch. They are shipped ready for installation.

For More Details Circle No. 29—Page 265

Extensometers: Tinius Olsen Testing Machine Co., 1118 Easton Rd., Willow Grove, Pa.—High-magnification S-type extensometers detect strain under both elastic and plastic tension test and transmit signals

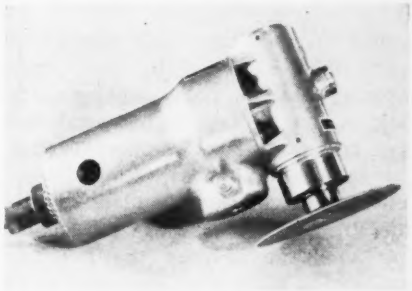
which rotate the recorder drum in direct proportion to strain on the specimen. Snapped on or off the specimen by squeezing the clamp plates, each instrument is provided with three high magnifications, which are instantly available by a switch and engraved indicator. Instruments are available for gage lengths of 1, 1.4, 2, and 8 in., with magnifications up to and including 1000. Calibration is based upon linear distances of the activating knife edge lever, which correspond to the linear distances for the recorder.

For More Details Circle No. 30—Page 265

Belt Trainer: Rapids-Standard Co., Dept. BT, 342 Rapistan Bldg., Grand Rapids 2, Mich.—Positive action belt trainer is designed to keep wandering conveyor belts aligned. It can be installed on any make of conveyor which has the return belt exposed beneath the bead and is intended for use on fabric or rubber covered belts 3/16-in. or more thick, operating at speeds up to 200 fpm. Unit is bolted to the flanged rails on the underside of the conveyor. Flat sides of the belt run between two sets of knurled spring-loaded rollers, with the belt edges contacting two sets of equalizer posts. If the belt creeps to either side, it presses against these equalizer posts. The loaded knurled rolls adjust the belt to the new direction. This forces the belt immediately back into alignment.

For More Details circle No. 31—Page 265

Electric Tool: Balmar Corp., Woodberry, Baltimore 11—Production tool for sanding, polishing, grinding, and shaping all types of wood and metal is 9 in. long, weighs 4½ lb, and is designed for one-hand operation. Unit is equipped with a 110 v,



ac or dc air-cooled motor and comes with three composition disks, 4 in. diam and 3/32-in. thick, a screw driver, and a 3/16-in. pin wrench. Special attachments include a collet chuck for ⅛-in. and 14-in. diam shanks, a spindle to hold carving tools, rotary files and rasps, hand cut rotary rasps for wood and comparable materials, and a variety of files and wood carving tools.

For More Details Circle No. 32—Page 265

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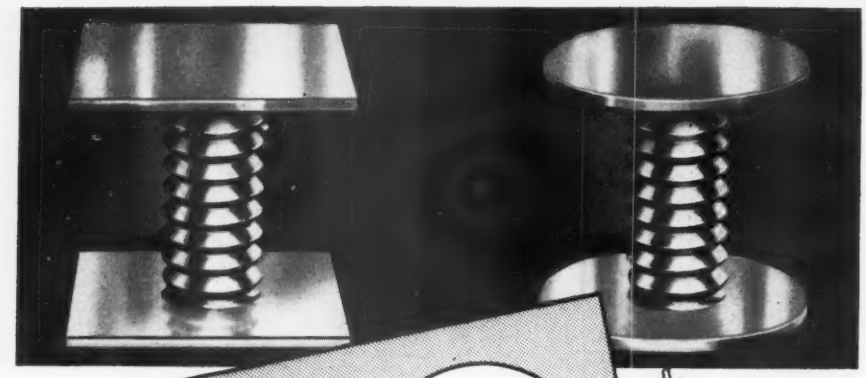

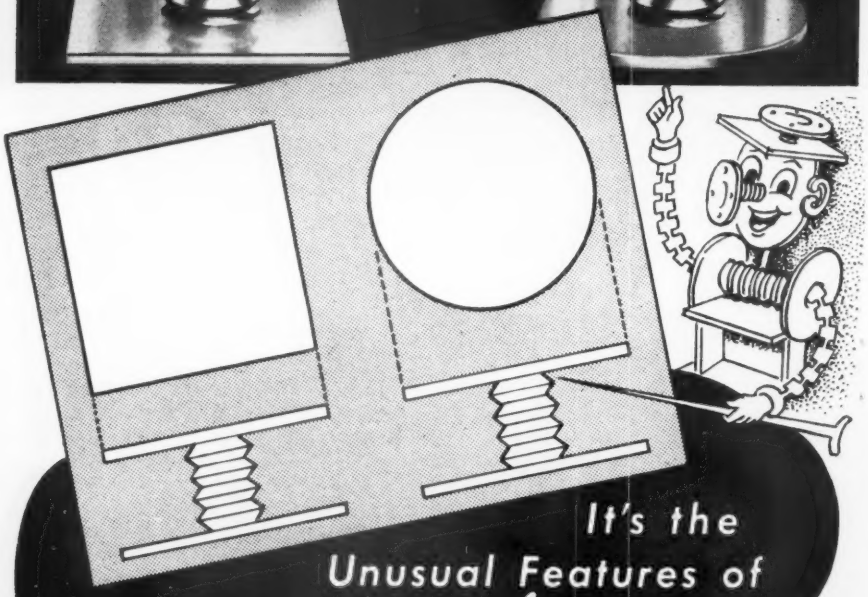

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Electric Furnace Melting

(*Continued from page* 133)

that, since the electric arc, rather than burning fuel, is the source of the necessary heat, the desired oxidizing conditions to produce a boil must be created entirely by rust on the charge and additions of iron ore, rather than partly by the excess oxygen in the flame. Upon the completion of the boil, too, conditions in the electric furnace will obviously be less actively oxidizing than in the fuel-fired furnace, so that the effect of the blocking additions should last longer.

When electric furnaces first were introduced, it was thought that the refining period was of the greatest importance, and every effort was made to create effective reducing conditions in the furnace, and to maintain them for a considerable time. Opinion of late, however, has swung over toward the view that deoxidation in the furnace by additions to the slag is no more than a prolonged "block," and that any possible benefits secured by it are more than offset by the re-absorption of gases in the metal.

Those who take this position apparently feel that the basic electric furnace, in steel foundries at least, had better be operated more like an open hearth, and the refining period be eliminated, or at least greatly shortened. One leading authority[3] has gone so far as to suggest that blocking additions might better not be made, and deoxidation be secured entirely by ladle additions. Those of us who were obliged to defend converter steel from the charge that it was necessarily of poor quality because it was deoxidized almost entirely by ladle additions, may be pardoned a sardonic chuckle at reading these recommendations.

The slag in the basic furnace is quite fluid and can be kept from running into the molds only by using bottom-pour ladles, or tea-pot ladles and "mustache-cup" shanks. Though the one-slag method with partial deoxidation gives more fluid steel, and therefore is more suitable for shanking small molds than the two-slag process, it did not in any way solve the problem of handling the slag. Even when a short refining period is used, however, it is faster and hence somewhat cheaper than two-slag operation, and it would probably have been quite widely adopted in the steel foundry industry a number of years ago had its advantages not been lost sight of when the acid process was introduced.

Acid Electric Process — The acid electric furnace is lined throughout

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with silica brick and sand, therefore the slag contains a very high proportion of silica. A silica lining is considerably cheaper than basic refractories, and steel can be made on an acid bottom a little faster than by the one-slag basic process. Further advantages of the acid method are that the steel is extremely fluid, and that the slag, being heavy and gummy, readily is prevented from running into the molds.

As both the one-slag basic and the acid method use the same grade of scrap, the faster acid process is somewhat the cheaper, and it is not surprising that acid furnaces soon displaced basic in all but a very few steel foundries. Though the basic process is still used in some shops, about 80 per cent of the small electric furnace steel castings made in this country today are poured with acid steel.

Method Has Limitations

As in any steelmaking method in which the metal is in contact with an acid furnace lining and under a highly siliceous slag, no phosphorus or sulphur can be eliminated from the steel in the acid electric furnace. Therefore, the process is not in any sense a refining one, though when it is properly carried out, the metal can be deoxidized quite thoroughly. The chief reason why it has been so widely adopted, in preference to other methods of making very hot metal for light casting manufacture, is that it will make steel from all-scrap charges, far cheaper than the obsolete crucible, and usually cheaper than the side-blown converter. The latter also generally requires a certain proportion of pig iron in its charge, though it can be operated on an all-scrap basis if necessary.

To keep production costs low, however, the electric furnace must be run steadily at or near full capacity. When business is slack and the furnace is operated only two or three days a week, the interest and depreciation on a comparatively costly piece of equipment, and the power companies' stand-by charge, based on the maximum 30-minute demand for current, greatly increase the cost of the steel. A cupola and side-blown converter, on the other hand, can be installed at such small expense, and their power requirements are so small, that in slack times the cost of converter steel is very little higher than when the equipment is operated at full capacity. Only when business is good, therefore, will the electric furnace make steel cheaper than a converter of comparable daily capacity.

The acid furnace usually is lined

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throughout with silica brick, though a course of high-grade clay brick is sometimes laid next to the shell. The bottom is composed either of silica sand of the same grade as that used in acid open hearth furnaces, or of crushed ganister. As in basic work, it formerly was standard practice to set the bottom by sintering in successive thin layers, heating the furnace by means of electrode butts laid on the bottom brick. Most operators today, however, prefer to mix the lining materials with pitch or with a small amount of clay and molasses or glutrin, ram the whole bottom in cold, and then sinter it.

Experience has shown that this method saves a great deal of time, and gives as good a bottom as a well sintered one. If the sintering is not properly carried out, the rammed-in bottom is much the better. The bottom must be examined for holes after each heat, and if any are found, the steel must be splashed out of them. The eroded area at the slag line and any holes elsewhere then are repaired with silica sand.

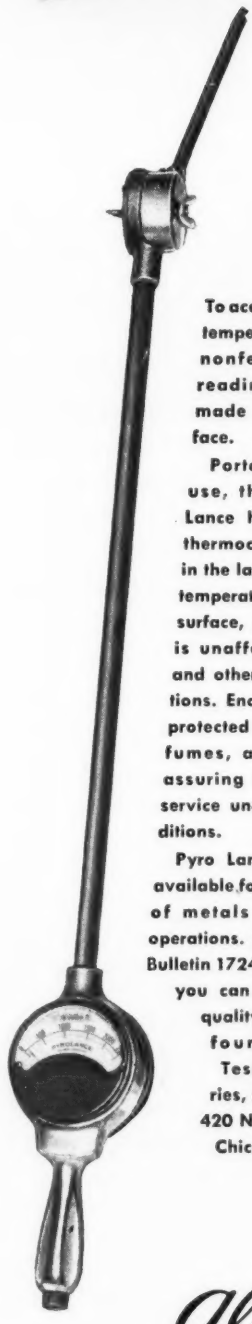
The make-up of the charge is the same as in single-slag basic operation except that no lime, and generally no slag-making material at all, is used. Sometimes a small amount of silica sand is added with the charge, and some melters prefer to introduce part of the iron ore or mill scale at the same time. As a rule, however, the oxidizing materials are not added until the steel is all, or nearly all, melted. A tight, well compacted charge is desired so that contact can be obtained immediately, and the scrap melted down with high voltage as rapidly as possible.

Working Practice Varies

Practice in working heats in the acid electric furnace varies greatly in different shops, but in general there are two distinct types of operation. In one a vigorous boil is set up and maintained for some time; in the other practically no boil occurs. The latter type, which Briggs terms the "partial oxidation" method, is designed to obtain the highest possible output from the furnace, with long refractory life, low power input and low electrode consumption. Since the castings produced are as a rule low-priced and subject to no requirements beyond soundness and surface smoothness, the quality of the steel made is a secondary consideration. Specifications involving mechanical properties are not usually involved, and freedom from pin-holes is secured by adding liberal doses of aluminum to the ladles, shanks or molds.

The charge for partial oxidation

in nonferrous foundries SURFACE INDICATIONS CAN BE MISLEADING



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Pyro Lance models are available for a wide variety of metals and foundry operations. Write today for Bulletin 1724-D and see how you can have low-cost quality control in your foundry. Illinois Testing Laboratories, Inc., Room 511, 420 North LaSalle St., Chicago 10, Illinois.

Alnor

PRECISION INSTRUMENTS FOR EVERY INDUSTRY

practice is so proportioned that during the melt, the rust on the scrap, plus a little iron ore if there is not enough rusty material available, will reduce the carbon of the melted metal to a few points below what is desired in the finished steel. The aim is to have the heat melt down with a carbon content which will be brought to the right point by the carbon in the manganese and silicon alloys added to give the desired amount of those metalloids.

If the scrap is very rusty, crushed electrodes or pig iron are used in the charge to bring the carbon high enough so that the melt-down will be right. If clean scrap with a high carbon content must be used, enough iron ore or scale is charged to lower the carbon to the proper degree. As the charge melts, a gentle boiling action takes place in the growing pools of metal, and the completely melted bath lies comparatively quiet, with only a slight, gentle boil observable. The carbon of the steel is then generally at or about 0.25 per cent, and the silicon from 0.15 to 0.25 per cent.

Sample Sent to Laboratory

As soon as the charge is melted, a sample is sent to the laboratory for quick carbon and manganese determination, and by the time the analysis is reported, the heat will be up to temperature, and the carbon a few points below what it was at melt-down. The calculated amounts of silicon and manganese are then added as ferroalloys; the silicon usually in the furnace, and the manganese quite often in the ladle, to cut down loss. A liberal dose of aluminum is used in the ladle, and frequently more is added to the shanks, or even to the stream entering the molds.

No attempt is made to free the steel from dissolved gases, or to reduce its oxygen content by any means except the usual effect of silicon, manganese and aluminum. The process, in short, is one of dead-melting scrap, and depending upon deoxidizing additions to make it set sound and free from pin-hole porosity. Steel made in this way to a certain extent resembles the crucible-melted product once so popular for steel casting manufacture.

The crucibles, however, were covered with lids made from the bottoms of old pots, which soon sealed fast and prevented air from coming in contact with the steel. The oxygen initially present in the pot was largely exhausted by reaction with silicon, manganese and iron of the scrap, and the opportunity for hydrogen absorption definitely was limited. The carbon of the graphite pot reacted with

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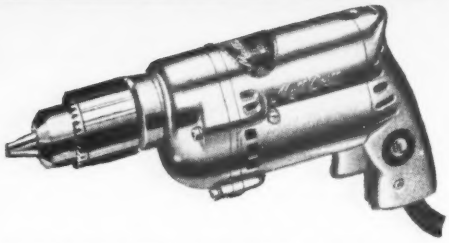

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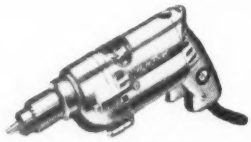

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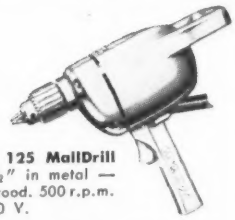

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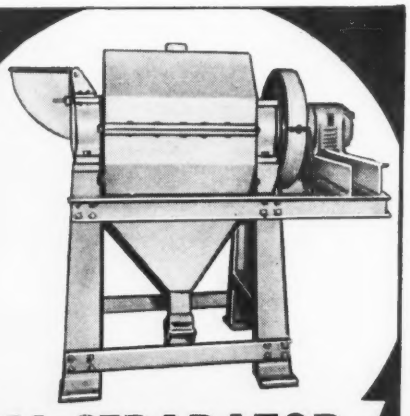

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oxygen in the melted steel, producing CO and deoxidizing the metal, and a certain amount of silicon was reduced from the clay mixed with the graphite. Finally, a certain amount of ferrosilicon and ferromanganese was generally used to complete the deoxidation of the metal. It is probable, therefore, that dead-melted crucible steel made from boilerplate punchings and clippings and pig iron or washed metal, though usually rather high in carbon, was a better material than acid electric furnace steel produced by the partial oxidation method.

Complete Oxidation Method — The majority of acid electric furnace operators today insist on a thorough and vigorous boil to free their steel from dissolved gases and, therefore, practice what is known as the complete oxidation method. Not all follow exactly the same procedure, especially as to the carbon content of the charge. Some prefer to melt down comparatively high and boil to around 0.20 per cent C, others use a lower initial content and therefore a lower carbon at the completion of the boil. All, however, eliminate the greater part of the silicon and manganese in the bath during the oxidation period.

Specifically, at melt-down the carbon varies from a minimum of about 0.18 per cent to a maximum of as high as 0.40 per cent, with Si between 0.13 and 0.20 per cent, and Mn from 0.25 to 0.35 per cent. After the boil, the Si will be as low as 0.20 per cent when the bath melts low in carbon, and some 0.10 per cent in heats with higher initial carbon; the Mn varies from 0.07 per cent or thereabout in heats melted low in carbon, to 0.15 per cent in more normal charges, and as high as 0.25 per cent when there is much intermediate manganese steel scrap in the charge. Briggs[4] states that the best acid electric furnace practice calls for "maximum residual of Si at 0.08 per cent and Mn at 0.15 per cent."

Some melters prefer to add part of the iron ore or mill scale with the initial charge, especially if they are using a good deal of high-carbon material, or if there is very little rust on the scrap. As a rule, however, the ore is introduced when the charge is nearly or entirely melted, with the object of obtaining a more vigorous boil. The ore or scale, of course, must be low in both phosphorus and sulphur; mill scale particularly should be analyzed, since it may have absorbed a good deal of sulphur from the oil used to heat the billets or blooms from which it came. The boil

should be maintained for at least 15 minutes and may be continued for 25 minutes or half an hour.

As the boil dies down, the power is reduced and sand may be added to increase the volume of the slag. When boiling ceases, the refining period begins. Most operators that melt down at a low carbon content recarburize the bath at this point with additions of low-phosphorus pig iron, crushed electrodes, coke or spiegel. A few prefer to dip the electrodes in the bath to increase the carbon content, but the general feeling is that the pick-up secured in this way is hard to control, and that it is better to add known amounts of carbon or carbon-containing metals.

Some operators add no slag-forming materials, others prefer to add extra silica sand to increase the slag volume and lower the proportion of FeO. As in acid open hearth practice, a good many authorities favor the use of enough limestone, or preferably burned lime, to raise the CaO content of the slag to 6 or 8 per cent. The CaO satisfies the need of the SiO_2 for bases, in the complex silicate slag, and so releases some of the FeO which reacts with the carbon of the steel and somewhat prolongs the boil.

Alloys Are Added

When the bath has reached proper temperature, the required silicon and manganese are added as ferroalloys. Some melters use 50 per cent ferrosilicon, and follow it up after 5 or 6 minutes with enough 80 per cent ferromanganese to give at least part of the desired manganese content; others prefer to use silicomanganese. If these alloys do not contain enough carbon to give the proper amount, more is added as pig iron, electrodes or coke. These deoxidizing additions are made as short a time before tapping as possible. As soon as they are melted, a "set-test" is poured to see if the metal solidifies quietly, and a test spoon full of the steel is skimmed clean of slag and the time required for it to scum over is taken. If the temperature thus ascertained is high enough, the heat is tapped.

Silicon recovery from the alloys added is fairly regular, but the loss of manganese varies quite widely and it is generally desirable to shovel crushed 80 per cent ferromanganese into the stream flowing into the ladle to contribute at least part of the required manganese. In fact, some operators make no furnace additions at all, but add 50 per cent ferrosilicon as well as the ferromanganese in this manner.

Table III shows the details of producing a small acid heat, made in

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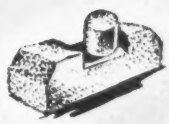

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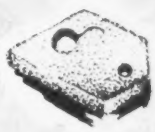

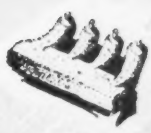

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accordance with standard complete oxidation practice. This heat was boiled about 20 minutes by means of a good-sized addition of iron ore, and low silicon pig iron was then charged to block further oxidation of carbon, also to build the carbon content up high enough so that the final additions would bring it to the specified amount. A small addition of lime, as described above, was made to this heat, to replace some of the iron oxide in the slag, and thereby improve the recovery of manganese from the final additions.

Two-Slag Acid Method—A few acid furnace operators, notably Caine[5], use a two-slag process. In this method, as soon as the boil subsides, the first, oxidizing slag is removed and the bare bath is recarburized. A second slag, containing about 6 to 10 per cent CaO, is then made up from sand and the required amount of burned lime, mixed on the floor, shoveled into the furnace and melted down as fast as possible. The total weight of the slag-making materials varies from 2 to 5 per cent of that of the metallic charge. As soon as the second slag is melted, the heat is deoxidized and finished in the regular manner.

It takes somewhat longer, and therefore costs a little more, to follow this practice. The chief advantage claimed by its advocates is that the FeO content of the final slag can be maintained at a very low figure, so that the recovery of silicon and manganese from the deoxidizing additions is uniformly high. Caine believes that the overall cost, including losses from rejected castings, is lower or at least no higher, than that of the usual single-slag method.

Silicon Reduction—Toward the end of the refining period in an acid furnace, if the temperature of the bath is brought to 3100 or 3200° F, silicon is reduced from the slag by carbon, according to the reaction:

$$2C + SiO_2 \rightarrow Si + 2CO$$

A little silicon is sometimes reduced in this way in acid open-hearth furnaces, but in the electric furnace the very high temperature at the arcs causes the reaction to proceed much faster. Many European operators believe that to make really good acid electric furnace steel, part of the silicon content should be obtained from the slag in this manner, and in this country some melters have adopted the method, chiefly to economize on ferrosilicon.

The heats are handled in the same way as in complete oxidation practice, except that extra power is turned on near the end in order to raise the temperature rapidly. According to Briggs[6], it is desirable also to maintain a high MnO content in the slag, because the amount of silicon that can be reduced varies directly with the proportion of MnO. Most of the silicon reduction takes place in a very few minutes toward the end of the heat, and the degree of skill required to obtain consistent results by the method is so high that it should be attempted only by melters familiar with all its details.

The author once had to run a furnace in which silicon reduction took place, whether it was desired or not. This was a 6-ton shell which had been lined down during a slack period to hold only 3 tons. The transformer was large enough to take care of a 6-ton heat, and was of an old-fashioned type, so that it was impossible to reduce the power input to a proper degree after the steel was melted. Naturally, soon after the bath was melted, it became overheated, and silicon reduction was so rapid that it was impossible to wait on the customary laboratory check on the melt-down carbon.

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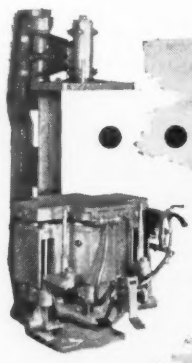

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As the various rapid methods of ascertaining the carbon content had not then been developed, we estimated the carbon by the fracture of the melt-down test, added ferromanganese and a little ferrosilicon, and tapped out the heat as soon as it was hot. If there was any delay, the silicon content reached far too high a figure. By present-day standards our control of the analysis of our heats would not be considered good, but at least we made hot, fluid steel that was shanked without undue trouble into very small castings.

Use of Aluminum — Aluminum is practically always added to acid electric furnace steel, preferably by wiring it to a steel rod and plunging it into the ladle when about half the metal has run out of the furnace. In many cases, it is simply tossed into the stream when the ladle is one-third full, and always before the slag has started to come out with the steel. Before its legitimate function in steelmaking was recognized, there was a certain stigma attached to the use of aluminum, and the author recalls many instances in which it was claimed that none was used, but the melter kept a store of aluminum shot concealed about his person, and added it more or less surreptitiously to the shank ladles. There was a very general feeling that to use aluminum was a confession that the steel had been improperly made, and had to be "doped" to make it set quietly in the molds.

At that time, too, the necessity of subjecting electric furnace steel to a thorough boil had not been recognized, and a great deal of acid steel was melted down "flat," at about the desired carbon content, heated up quickly, and finished with only small additions of silicon and manganese. The author even remembers being told by the melter on one of the early, primitive single-electrode furnaces, that the way he told when the heat was ready to pour was to notice when the roof started to drip. Naturally such steel was gassy, and aluminum had to be used to make it set free from pin holes. Haunted by the prevailing distrust of aluminum, melters added to the ladle the smallest amounts that they thought would make the steel solidify quietly. Often larger additions were made to the shanks used to pour castings when there were no coupons for mechanical tests.

Many of the tests made from metal treated with these minimum amounts of aluminum showed low percentages of elongation and especially of reduction of area, and broke with what was called a "woody" fracture. Known as "aluminum embrittlement," this deficiency in mechanical properties was the bugbear of acid electric furnace operators, until the researches of Sims and Dahle[7], and Gagnebin[8] and others showed how it could be (and now is) largely avoided. Amusingly enough, the remedy for low ductility due to the use of aluminum was found to be more aluminum—like "the hair of the dog that bit you" as a specific against rabies.

(To be concluded next month)

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Effect of Raw Materials on

CUPOLA OPERATION

By BERNARD P. MULCAHY
President
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Indianapolis

Effective sorting of poorly graded scrap and the handling of borings in making up cupola charges are discussed in this third of a series of articles which began in March

USE of hard or chilled iron scrap in the cupola in most instances should be restricted for the same fundamental reasons as burned iron. This interpretation, however, needs some modification. In discussing pig iron earlier in this series mention was made of the "historic" effect of certain innate characteristics which we cannot explain theoretically. That is, the persistence of properties which, we can rationalize, should be lost in the melting process. Hard iron occupies this same position of effect.

Chemically this iron is better than burned iron, but it has purposely been hardened to a state of whiteness by induced rapid chilling, preventing the precipitation of free graphite. Examples are car wheels, brake shoes, bells, etc. The effect on normal gray iron when this material is in the mix, is to have some erratic persistence of hard spots show up in the castings. It is therefore obvious that the presence of such iron in the mix nullifies other hard-earned efforts at control of quality.

Nonferrous Materials—The current lack of sorting scrap has, of course, added to the burden of today's cupola operations, not only with respect to poor sizing but also the inclusion of appreciable quantities of nonferrous materials. Commonly these are aluminum, lead, brass, copper, zinc, bearing metal, etc.

Probably the most prevalent and injurious is aluminum because of the relatively large quantities encountered. This material occurs as pans and pistons on auto blocks, washing machines, pipe and other fabricated articles. Some of this material is easily recognized when the scrap is examined; frequently, however, it is heavily coated with grease and dirt, and slips by undiscovered.

The effect of aluminum in the scrap, according to some, is to cause pinhole porosity in the castings. Lead in the form of the metal itself or in bearings also contributes to a "rotten" structure. Although copper is used extensively in gray iron as a graphitizer, it is done so with intent and under controlled conditions. When charged in appreciable amounts either as brass or extraneous copper it can produce undesirable results.

Obviously these nonferrous materials when contained in the general scrap are completely undesirable because of their uncontrolled and erratic amounts and in certain cases the native injurious effects. It is quite apparent that when the proper raw materials are difficult to obtain we must exercise even greater-than-normal care in selecting the scrap charged.

Borings—The availability and generally attractive price of gray iron borings has constantly stimulated attempts toward their use in quantity in the cupola. This material has been charged as briquets (most common form), native and with carbonaceous substances, packaged in pipes or cans, loose in the regular charge and even blown in through special ports in the side of the cupola. It has been added in amounts from 5 to 60 per cent with, of course, varying degrees of success and failure.

When borings are used in any quantity and regardless of form, it often is found that carbon is difficult to maintain, silicon losses are high and the metal has the characteristics of oxidized iron. It is thought, of course, that briquetting will generally condition borings to permit their satisfactory use. This may or may not be the case. Unless the briquetting machines are supervised constantly there is a tendency for a lessening of the packing density, with consequent degradation of the briquets in handling.

Frequently the briquets are handled by magnets and seldom are they rescreened before use. This results in all of the fines re-generated by normal handling being charged as such. Unquestionably, borings are best charged as briquets, because the other forms simply aggravate the effects mentioned.

The reason for the injurious effects resulting from the use of borings is the matter of size. In this instance we have an exaggerated condition, and in consequence the result is greatly magnified. The particle size of borings, of course, is extremely small and therefore the surface exposure is enormous. If charged loosely the material easily sifts through the preceding charges as the stock shifts and moves.

Many of the small particles melt as such and do not coalesce in their descent. The innumerable tiny droplets offer tremendous surface to the gases with the results noted.

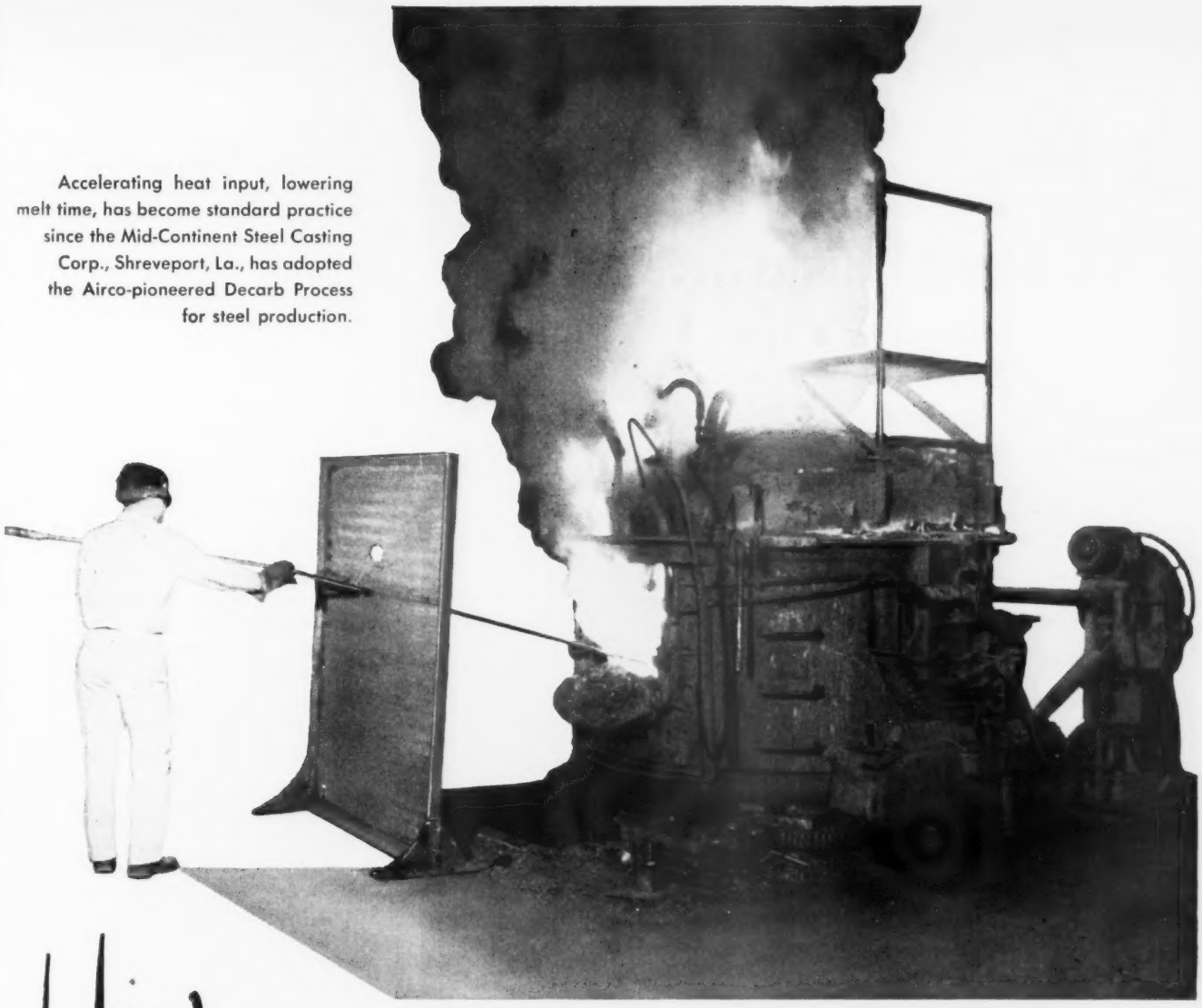
Steel Content—Today's poor grading of cast iron scrap unquestionably has automatically increased the steel content, both as an integral part of certain machine parts as well as individual pieces. This frequently accounts for variations in both carbon and silicon in the final metal with the obvious effects.

When this condition exists in the scrap it is not always possible to compensate for it because of its erratic occurrence. If the steel content is nominal, corrections can be made in the charge or mode of operation, but when the amount is variable we will note its effect in varying carbons and silicon during the heat. The obvious correction is the removal of the steel from the gray iron portion of the charge and recharging as steel with the proper adjustments. In this manner the amount charged is properly determined and accounted for.

Sorting of Scrap—One of the most effective means of combating poor materials and short pig iron supply is the sorting of the purchased scrap at the plant prior to use. This suggestion may sound like an impossibility for most plants, but actually a great deal can be accomplished right at the time of charging.

The previous discussions have pointed out the materials commonly present in purchased scrap which can and do cause considerable trouble in the metal poured, so that no question

(*Concluded on page* 286)



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(*Concluded from page* 284)

should be raised regarding their removal. The problem therefore is how this can be accomplished in a practical manner.

Where large daily tonnages are charged and magnet handling is employed, it is almost impossible to sort the scrap except and unless it is done on a regular basis as the scrap is received. Some plants have established a regular station for this purpose with, of course, excellent control and effect.

In the smaller shops even with mechanical charging a good job can be done as the charges are made up by having the man at the station pick out all of the undesirable material. With proper and constant supervision the crew will quickly recognize the material which should be removed and will do so effectively and reliably. It is a much easier job, of course, to sort out the scrap when individual charges are prepared in advance of charging. Here, with a little training, the men can do an almost 100 per cent effective job.

(*To be continued*)

MIT To Dedicate New Lab For Metals Processing

Massachusetts Institute of Technology, Cambridge, Mass., will dedicate its new metals processing laboratory June 3. The dedication program will be followed on June 4 and 5 by a 2-day technical conference on metal cutting, featuring speakers of national reputation in the metal cutting field.

Dedication exercises for the new building, made possible by a gift of $1 million from Alfred P. Sloan Jr., chairman of the board, General Motors Corp., will include a presentation address by Mr. Sloan and an address of acceptance by James R. Killian Jr., MIT president.

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Shell Molding Process

(*Continued from page* 117)

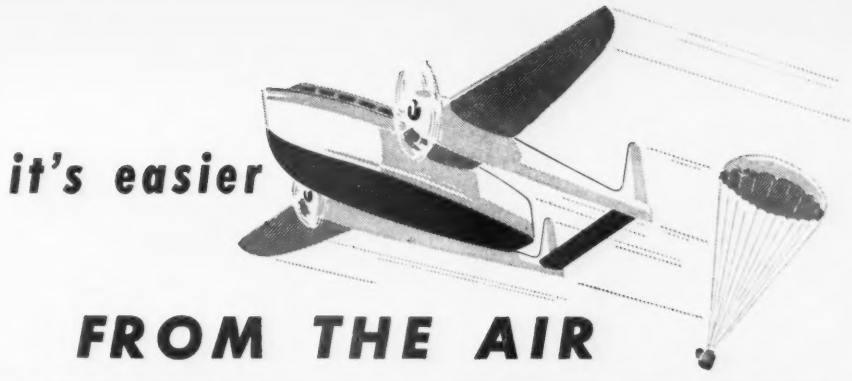
In this investigation, for the most part, alloy cast iron patterns of the low expansion, heat-resistant types were utilized. Excellent overall performance was obtained with these patterns, particularly in resistance to "sticking" which may be due to the high surface graphite population of those alloys. On occasion, hand finished bronze castings were utilized and operated satisfactorily, but proved to be subject to nicking, scratching or swaging to a degree not normally experienced with iron or steel.

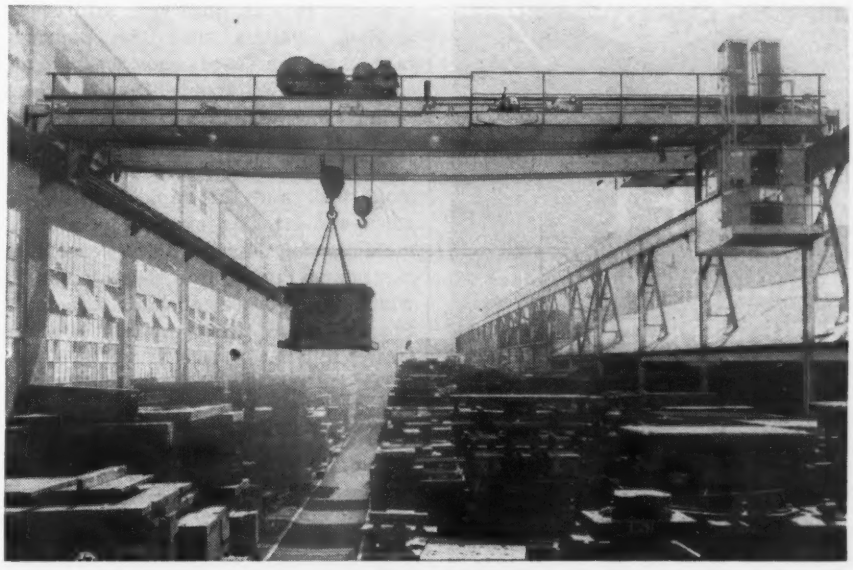
The cycling temperatures developed permitted the use of aluminum sprues, runner bars and risers. When plate weight was a factor, ribbed aluminum pattern plates and patterns were utilized satisfactorily. An example of an all-aluminum pattern plate for a motor bracket casting is illustrated in Fig. 6. In this particular casting no draft can be tolerated on the mounting face of the bracket, which represents a 1½-in. draw.

The pattern plate is the heart of the process and must be well engineered if production difficulties are to be avoided. The availability of the right kind of machine tools and skilled tool and die or metal pattern-making personnel is essential for manufacturing the patterns or effecting quick accurate changes in gating and heading. The pattern plate should be ribbed, and designed with uniform sections and sufficient thickness to retain the proper temperature head for setting the investment on a continuous operating basis.

Generally, rivet type heads are used for stripping pins, and the greater the area of each head, the more efficient the stripping action, provided they are spaced uniformly around the pattern. Stripping pins should be outside the mold cavity and equipped with properly tempered springs or a mechanical arrangement for automatic return after the release of the mold. In the example of a pattern and plate for a mounting panel casting (Fig. 1) note the bolting lugs, some of which are used for bolting mold halves together. These lugs also serve to prevent "drops" when the pattern plate is removed from the molding machine and inverted to its normal position.

Gating and Heading—Sound principles of gating and heading cannot be ignored in this casting process if castings free from objectionable internal defects are to be manufactured.





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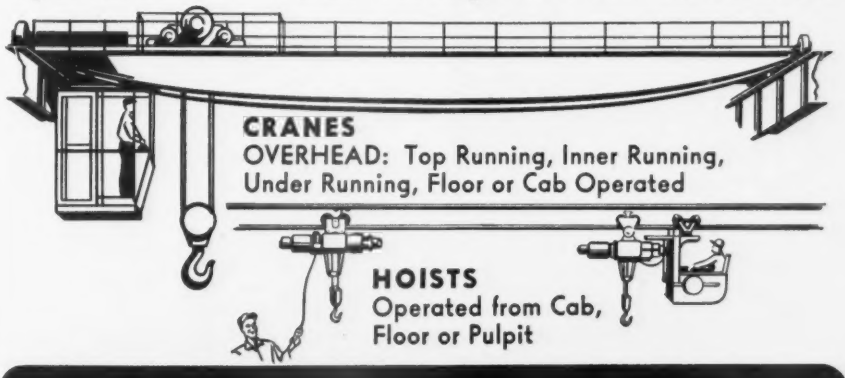

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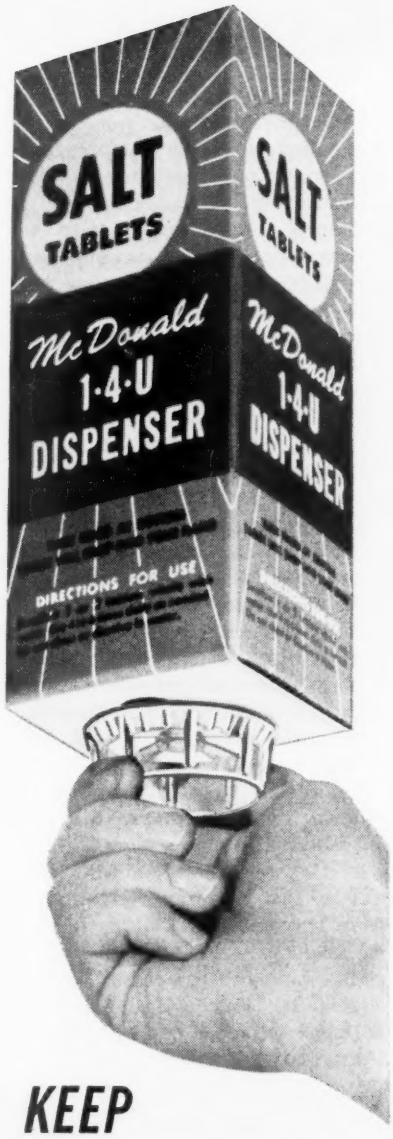
Gating methods which provide for pouring molds on end lend themselves to the best productive arrangement for supporting the molds with a back-up material. For high surface finish quality, it has been found necessary to bottom gate. In aluminum alloys, tin bronzes, malleable, gray and particularly ductile iron, choked ingates and the judicious use of dross catchers must be practiced at all times.

Tapering the downsprue in an area ratio of 4:1 has been found desirable. It was observed with shell molded castings that the pouring rate was increased considerably as compared with conventional green sand systems, despite the severe choking. This is believed due to the lessened surface resistance of the mold wall and the rapid venting of gases and air. An example of a shell mold gating and heading arrangement for a ductile iron staging clamp, which incorporates such choking and dross catching arrangements, is illustrated in Fig. 10.

It has also been noted that increased yield can be obtained with shell molded castings compared with green sand cast products. An example of this is illustrated in Figs. 7 and 8, which show the master pattern plate arrangement and casting, respectively, for a 0.45 per cent carbon steel, 12-in. diam wire rope block sheave wheel. To produce this casting radiographically sound by green sand practice necessitated risers on the periphery or chill inserts in the core around the root of the groove. As illustrated in Fig. 9, this casting is currently being shell molded with a conventional zircon core and no chills. In addition to producing a radiographically acceptable casting, all machining has been eliminated with the exception of a facing and boring operation on the hub and a filing operation on the root of the groove.

This casting is an illustration of an application of shell molding where improved yield and the elimination of certain machining operations justified the use of this method even though very close tolerance and high surface finish were not particularly important.

Dimensional Tolerance—The shell molding process can be considered a "precision" casting process. It is generally thought of as being midway between sand casting and the lost wax technique. However, it is believed that if castings approaching the size of those commonly made in shell molds were manufactured by the lost wax process, no greater degree of tolerance would be obtained.



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Tolerances of .003-in. per in. are considered to be feasible in most alloys on fairly large castings. Extremely close tolerances can be obtained in the aluminum alloys. The mounting panel casting illustrated in Fig. 11 was held to ±.010-in. on the overall length and width and to ±.005-in. in the width and depth of the gasket groove.

Shell molding, however, has one basic limitation insofar as maintaining dimensional tolerances is concerned, and that appears to be the inability to achieve outside diameter concentricity on a vertically parted cylinder. The OD dimension of a shell mold along the parting line, which is held by some mechanical arrangement or by pasting, and acts as a stiffening rib, will frequently produce castings up to 0.35-in. smaller in diameter than the OD dimension 90° from the parting line. In some instances, an actual flat along the parting line can be detected in the casting. A proper allowance in the master pattern will overcome this deficiency, in part. To avoid excessive OD eccentricity on vertically parted cylinders, it is essential that close control of resin-sand mixtures, cycling, shell thickness, and method of backing up be exercised.

The apparent stability of shell molds with regard to resistance to deterioration and moisture absorption, coupled with their structural strength and lack of dimensional change, make them particularly suitable for storage over indefinite periods. Consequently, it may not be impractical to consider the storage of large quantities for critical casting work or the shipment of molds between plants, thus reducing duplication of master pattern equipment.

Shell molds also have a high degree of permeability, which is apparent by the ease with which smoke can be blown through them. Hence, if a backing material of high permeability is utilized, the gases generated from the decomposing organic binder are adequately vented with very little back pressure. This, coupled with low frictional losses due to the smooth mold face, permits the running of sections which normally would be a problem in conventional sand molds. A typical shell mold is illustrated in Fig. 12.

Closing Molds — Molds may be closed in a variety of ways depending upon the degree of tolerance desired in the castings. Clamping the outside edges with spring wire or utilizing a cold setting paste is practical. It has been found, however, that bolting the molds closely about the casting cavities will yield the best

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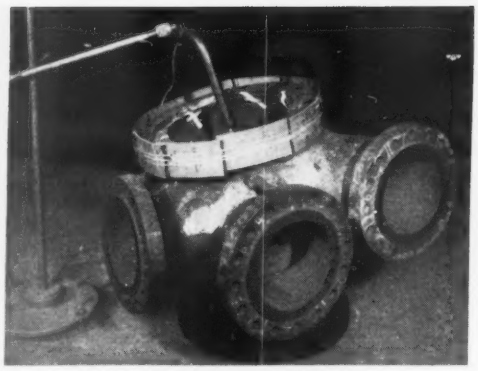
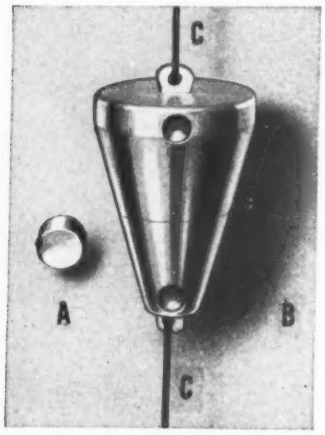


Radiographing a flange on a heavy steel casting.



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results. In some instances no mechanical clamping device is utilized, and the molds are held together closely by the vibrated steel shot back-up material. A mold closed by bolting is illustrated in Fig. 13.

It has been the general practice to back up molds with steel shot. The prime purpose of the back-up material is to resist deformation of the mold wall under the hydrostatic head of metal pressure. The use of shot represents one of the critical material handling problems in the general process. Such problems as shot overheating, removal of fines from the shot, shot loss due to metal spillage, and the safety hazards involved when loose shot is on the floor in the pouring area, have not been fully resolved. Other materals such as coarse silica blasting sand have been investigated and are being utilized successfully. Whatever material is used, however, should be vibrated during backing up and should have sufficient permeability, since this factor is an important one in venting mold gases. In some instances when the total weight of the castings poured into shell molds is small, no backup material is required.

Cores — Shell core blowing techniques have not advanced as rapidly as shell moldmaking. The principal difficulties in core blowing have been resin segregation, venting and corebox wear. At this stage of development core "dumping" practices appear to be more successful. Shell cores which have been produced by either the blowing or dumping technique have yielded excellent surfaces in both gray iron and nonferrous alloys. Shell cores coated with a zircon wash will also yield satisfactory surfaces in medium carbon steels. In industry, today, simple shell cores are being manufactured for both malleable iron and medium carbon steels, on a competitive basis with conventional dry sand core practice.

Mechanization—When the required volume of casting production is sufficiently high, favorable opportunities exist for a complete mechanization of the shell molding system. One of the outstanding advantages of the process is the fact that unskilled labor may be employed, and lower grade skills utilized. Industrial equipment currently being designed or recently placed on the market is generally of two basic types, one in which the stations or operations are incorporated in a single, automatic molding machine, and the other a typical loop with separate stations for moldmaking, curing, stripping, coating the pattern, and preheating. The former

system utilizes one pattern plate, while the latter requires several plates for continuous operation.

In the loop system, a "dutch" type oven, either electrically or gas-heated, with temperature control and variable belt speeds, is satisfactorily used for curing and preheating. The dwell time in the molding operation will determine the rate of production. Some systems use an overhead investment dispenser in the molding operation, while others use the conventional mold inversion technique.

Plant Safety—The pulverized and fine silica sands in the investment preparation may constitute a respiratory hazard to the molding room operators. Gases such as ammonia, liberated by the resins during mold curing, are similarly unpleasant. The mixing of resins should be done under hoods, or with dust guard protection. Odors emitted from decomposing molds during and immediately following pour-off are acrid but no worse than other foundry odors. The possibility of contact dermatitis should not be ignored, particularly when handling phenolic resins containing hexamethylenetetramine.

Metallurgy—It has been a generally stated premise in connection with this process, that castings produced in steel-shot-backed molds are subject to a greater skin chill than those poured in conventional green sand or in "unbacked" shell molds. The evidence obtained in this portion of the investigation, conducted on some nonferrous alloys, did not confirm this concept. Fig. 14 illustrates the effect of various kinds of backup material on the grain size pattern of a gun metal bronze wedge casting. All shell molds in this instance were ⅛-in. thick and were poured at 2050°F. The finer grain size pattern in the green sand control casting will be noted, indicative of a greater rate of cooling on solidification in green sand than in the plastic bonded shell molds, or a greater insulating effect of the plastic bonded sands. In addition, there are no appreciable differences in grain pattern between the copper shot and steel shot despite great differences in their thermal conductivity, which is another indication of the insulating effects of shell molds.

Exographs of ⅛-in. bronze slices shown in Fig. 15 further illustrate the effect of various shell mold backup materials on internal soundness and skin chill, as compared with green sand controls. The greater degree of internal soundness in the shell molded castings as opposed to the green sand castings and the great-

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er degree of internal soundness of the shell molded castings backed with steel and copper shot as opposed to sand and grit, will be noted. The latter is probably due to the higher permeability of the shot, which permitted more rapid venting of the mold gases.

Fig. 16 illustrates the effect of varying shell thickness on the macrostructure of a bronze wedge test casting. Note the tendency for a decrease in grain size with decreasing shell thickness and also that even the thinnest shell yielded a larger grain pattern than the green sand control, again indicative of the insulating effect of shell molds.

Figs. 18 and 19 show qualitatively the effect of base sand composition on solidification rates. The macro grain size developed in zircon sand shell molds as compared with silica sand shell molds or the green sand controls indicates a higher rate of heat extraction by the zircon shells in both aluminum and tin bronze alloys.

Shell Cast Bars Superior

Fig. 20 illustrates a comparison of mechanical properties in a 5 per cent silicon-aluminum base alloy between as-cast shell mold tension specimens and green sand test bars at various pouring temperatures. It will be observed that at the higher and optimum pouring temperatures the properties are slightly superior for the shell cast bars as compared with the green sand bars. It is believed that the slightly superior properties of shell cast bars at the temperatures noted is due to the cleaner fractures obtained. The results plotted represent averages of four bars from two separate heats, for each temperature.

A series of heats was also run to secure data relative to comparative tensile and elongation properties of shell molded and green sand molded tin bronze tensile bars cast at varying temperatures. The pattern equipment consisted of a double, bottom gated Navy Fig. 10 A test coupon mounted on a 14 x 18-in. pattern plate for shell molding, shown in Fig. 17, and a wooden counterpart for green sand molding. Two types of tensile bar inserts were used for each pattern—one, a pair of bars of oversize gage diameter requiring machining to finish to .505-in. gage diameter, and the second, a pair calculated to cast to approximately .505-in. gage; the purpose of the latter set was to secure additional data relative to the skin chill effect, or lack of skin chill.

Fig. 21 illustrates graphically the average yield strength, ultimate strength and elongation curves for the duplicate heats in which the as-

cast .505 gage was used. The shell cast bars show higher ultimates and elongations at virtually all pouring temperatures and lower yield strengths. The machined bar series shown in Fig. 22 follows the same pattern with higher ultimates and elongations for the shell cast bars and lower yield strengths throughout the range. As indicated above, bottom gating was employed on both the shell cast and green sand bars. While this is not considered to be a practice which will yield the ultimate in properties for the design of test bar employed, nevertheless it was necessitated by the fact that shell molds require this type of gating. Although the ultimate in properties probably was not attained, the gating system did afford a direct comparison between shell cast and green sand cast test bars.

Generally, from a metallurgical point of view, the indications are that shell molded castings in the aluminum alloys and low-leaded tin bronzes can develop ultimate strengths and ductilities at least equal to, if not slightly superior to, green sand castings. The lower yield strengths developed in the shell molded gun metal bronze test bar castings are believed to be associated with the slower cooling rate of shell molded castings. The trend toward slightly higher ultimate strengths and elongation values is attributed to cleaner metal with less gas inclusions and dross.

Applications and Economies — From an overall point of view every casting design is not suited to the shell molding process. Tooling costs are relatively high, hence the necessary volume is a basic requirement. Secondly, the design of the casting must lend itself to a suitable parting and gating arrangement. Thirdly, and possibly the most important factor, will be how much will be saved in the cleaning room and machine shop, since the greatest economies will obviously be in those departments.

No general rule for a cost comparison with sand castings can be derived. Each casting must be examined on its own merits. Another consideration which may be a factor in considering the utilization of the shell process as a production technique involves the conservation of material normally removed during machining operations. For example, an item may be machined quickly and cheaply on an automatic screw machine from bar stock; however, if a large part of the original material is removed in the machining, it may be advisable to consider shell molding

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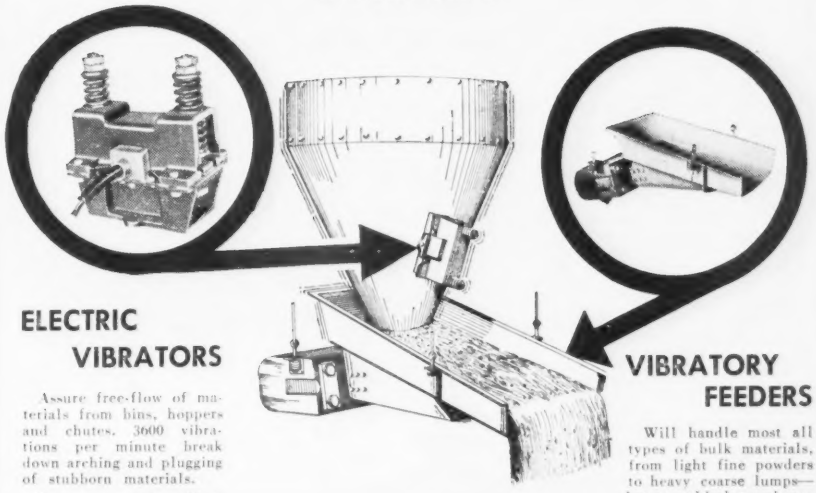

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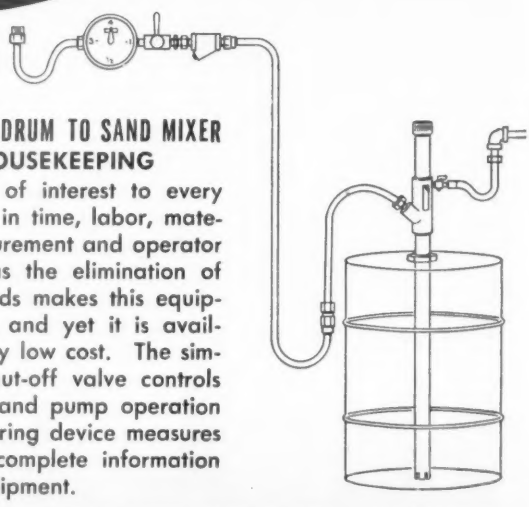

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Summary—Based on the results of the subject investigation, to date, the following conclusions may be drawn:

1. The shell molding process, engineered for proper application, is considered to be an economical foundry technique.

2. The shell molding process is considered to be a "precision" process which is capable of producing castings in aluminum alloys, tin bronzes, gray iron and ductile iron with excellent surface finishes and to tolerances of .003-in. per in.

3. Sound medium carbon steel castings may be produced in shell molds, but additional work on improving surface finish is required before extreme tolerances may be obtained.

4. Shell molds are most compatible with aluminum alloys, gray, ductile and white iron alloys, from the standpoint of surface finish and maintaining close dimensional tolerance.

5. The shell mold process may be fully mechanized and the operation does not require special skills. Operators may be trained to run a production line in several hours.

6. Shell molds are very stable, dimensionally strong, and resistant to moisture absorption.

7. Castings produced in shell molds in the alloys studied, i.e., aluminum and tin bronze alloys, are comparable or better than sand castings from the standpoint of internal soundness and physical properties.

8. Shell cores may be made successfully by the "dumping" technique but additional research is required in core blowing.

9. Improved foundry yields are generally obtained in castings produced by the shell molding process which, in some alloys, represents a conservation of critical alloys.

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10. "Jobbing Foundry Adopts "C" Process for Making Shell Molds," A. W. Calder, Jr., *Iron Age*, volume 168, No. 20, November 15, 1951; pgs. 111-116.

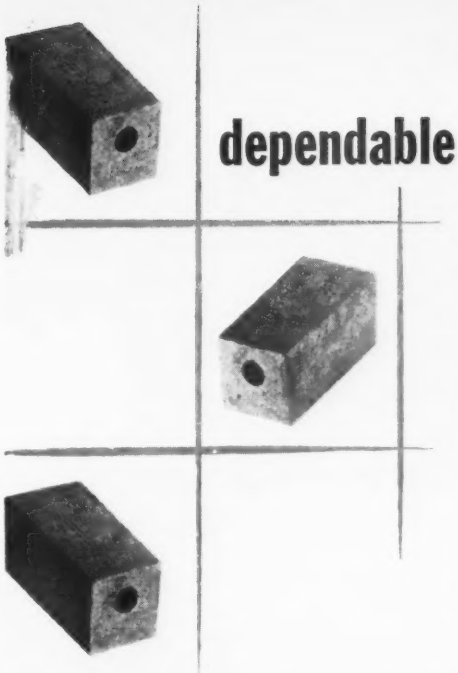
Book Review

Transactions of the Industrial Hygiene Foundation of America, paper, 91 pages, 6 x 9 in., published by the foundation, 4400 Fifth Ave., Pittsburgh 13. Price $1.50.

This bulletin 19 of the *Transactions*, 1951, contains the speeches, papers and discussion presented at the 16th annual meeting of the Industrial Hygiene Foundation held in November, 1951. Theme of the meeting was "The Executive and Health." At the end of the book are listed the board of trustees, executive staff, research advisory council and the various committees of the foundation.

Titanium Research

Glidden Co., Cleveland, and Bohn Aluminum & Brass Corp., Detroit, are sponsoring a joint program of research into titanium. First objective of the program is to find an economical method to produce pure, ductile, titanium metal. Other objectives include development of special purpose alloys and techniques of fabricating the metal and its alloys into various types of equipment and parts.



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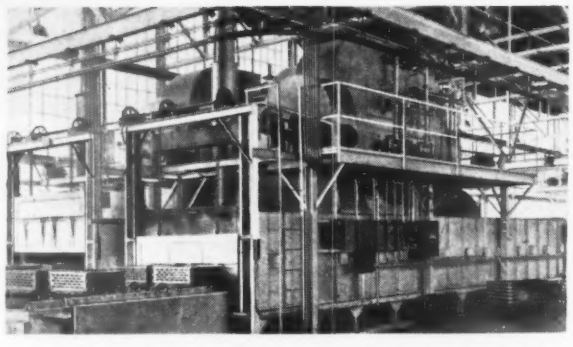

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..TRADE PUBLICATIONS..

For More Details Use Reply Card—Page 265

STEELS: Lebanon Steel Foundry, Dept. N, Lebanon, Pa.—Revised reference charts covering carbon, alloy and stainless steel casting materials, give specification designations, analyses, physical properties and heat treatments. Corrosion and heat resistant alloys are covered in one chart; carbon and low alloys in the other.
For More Details Circle No. 90—Page 265

DUST RECORDER: Minneapolis-Honeywell Regulator Co., Brown Instruments Division, Wayne & Windrim Aves., Philadelphia 40—Instrumentation data sheet 10.14-6 describes General Power Plant Corp.'s gas dust analyzer equipped with a Brown electronic potentiometer. Operation and application data are included.
For More Details Circle No. 91—Page 265

LIMIT SWITCHES—General Electric Co., Schenectady 5, N. Y.—Three new bulletins covering rotating, lever and track type limit switches contain descriptive and application information, switch ratings and a number of photographs and dimension drawings.
For More Details Circle No. 92—Page 265

GLOVES: Richmond Glove Corp., 629 North D St., Richmond, Ind.—Catalog 52 on industrial work gloves contains descriptions, features, packing, and shipping weight on 45 types of gloves. All-leather, leather palm, canton flannel, and jersey gloves are featured.
For More Details Circle No. 93—Page 265

ELECTRIC TRUCKS: Barret-Cravens Co., 4609 South Western Blvd., Chicago 9—Bulletin 5143 contains specifications, illustrations and drawings of four "walkie" electric trucks designed for lifting, moving, and stacking heavy loads.
For More Details Circle No. 94—Page 265

COMPRESSORS: Clark Bros. Co., Olean, N.Y.—Bulletin 118 describes operation principles and construction features of the company's balanced opposed motor-driven air compressors. Various models are illustrated and specifications are given for each.
For More Details Circle No. 95—Page 265

DIAMOND WHEELS: Norton Co., 302 New Bond St., Worcester 6, Mass.—Booklet offers many "do" and "don't" suggestions on the proper use and care of diamond grinding wheels.
For More Details Circle No. 96—Page 265

SUPPLIES: E. S. Lord Ltd., Eagle Oil Works, Bury Rd., Rochdale, Lancs., England — Catalog covers company's line of core binders and foundry supplies from nails to cupolas.
For More Details Circle No. 97—Page 265

FURNACES: Westinghouse Electric Corp., Box 2099, Pittsburgh 30—Booklet B-5459 describes 12 different

types of heat treating furnaces, both gas and electric, and outlines their chief field of application. Included are data describing material handling methods in furnaces, atmospheres suitable for heat treatment of different metals, average general performance data, and a glossary of heat treating terms.

For More Details Circle No. 98—Page 265

INVESTMENT CASTINGS: Austenal Laboratories Inc., Microcast Division, 224 East 39th St., New York 16—Booklet describes the company's process of producing investment castings. Charts list compositions and characteristics of alloys cast by the company. Advantages of the process for producing intricate parts are discussed.

For More Details Circle No. 99—Page 265

CUT-OFF WHEELS: Abrasive Wheel Dept., Manhattan Rubber Division, Raybestos-Manhattan Inc., Passaic, N. J.—Bulletin 6921 covers grade recommendations, cutting performance data, and operating suggestions for company cut-off wheels used on machines made by Stone Machinery Co.

For More Details Circle No. 100—Page 265

BELT REPAIR: Magic Chemical Co., Dept. N4, 121 Crescent St., Brockton 2, Mass.—Folder gives information on a self-curing (cold) plastic rubber compound for repairing conveyor belts. Names of industrial users and case history reports are included.

For More Details Circle No. 101—Page 265

DUST COLLECTOR: Pangborn Corp., Hagerstown, Md.—Bulletin 914 contains photos, drawings and discussion on how clothbag dust collectors work and how they are installed and maintained. It also gives specifications of standard collector sizes and dimensions.

For More Details Circle No. 102—Page 265

CONVEYOR ANALYSIS: Logan Co., 580 Cabel St., Louisville 6—Set of conveyor analysis forms are designed to help in analyzing handling problems, locating new sources of production efficiency, through better handling, and estimating present cost of handling.

For More Details Circle No. 103—Page 265

NOISE: Industrial Accoustics Co., 333 Jackson Ave., New York 54—Pamphlet on industrial noises and their control illustrates the principles of noise measurement and how these noises are related to the human ear.

For More Details Circle No. 104—Page 265

HEATERS: Edwin L. Wiegand Co., 7596 Thomas Blvd., Pittsburgh 8—Folder F-1530 on portable and built-in electric air heaters describes convection, blower, duct and radiant types along with suitable automatic controls.

For More Details Circle No. 105—Page 265

FORK LIFT TRUCKS: Towmotor Corp., 1226 East 152nd St., Cleveland 10—Series of three broadsides ex-

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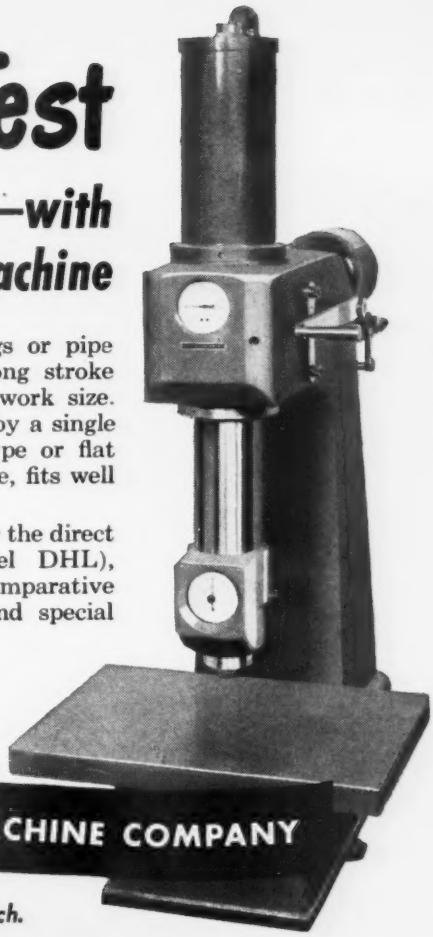

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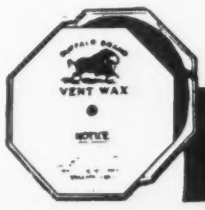

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plains specific points of interest about the company's trucks. No. 1 gives detailed and illustrated data on construction features; No. 2 is a feature-by-feature examination of truck elements, and No. 3 discusses truck maintenance from the mechanic's point of view.

For More Details Circle No. 106—Page 265

WELDING: Ampco Metal Inc., 1745 South 38th St., Milwaukee 46—Reprint entitled "Jobs You Can Do With Bronze Electrodes," describes welding techniques and correct choice of bronze electrodes to be used in welding gray iron gear housing and other parts.

For More Details Circle No. 107—Page 265

INSTRUMENTS: Leeds & Northrup Co., 4934 Stenton Ave., Philadelphia 44—Catalog section ED presents company's complete line of standard galvanometers, dynamometers, direct current indicating amplifiers, and accessories for use in full-balance or calibrated deflection measurements.

For More Details Circle No. 108—Page 265

MICROSCOPES: Bausch & Lomb Optical Co., 635 St. Paul St., Rochester 2, N. Y.—Catalog illustrates and describes various models of the company's stereomicroscopes. Accessories for these three dimensional microscopes also are listed and described.

For More Details Circle No. 109—Page 265

LUBRICANT: Climax Molybdenum Co., 500 Fifth Ave., New York 36—Booklet describes molybdenum disulfide for use as a lubricant. Form of the lubricant to use in many applications in different industries is suggested with remarks about the application.

For More Details Circle No. 110—Page 265

REFRACTORIES: Ironton Fire Brick Co., Ironton, O.—Bulletin 102 provides general information on refractories resistant to soda ash slags for lining desulphurizing ladles. Step-by-step procedures for lining ladles are described and illustrated.

For More Details Circle No. 111—Page 265

ROOF DECKING: Airtherm Mfg. Co., 758 South Spring Ave., St. Louis—Catalog 201 describes steel decking designed to provide a strong, safe, durable roof. Specifications, tables of loading stresses and method of erection are covered.

For More Details Circle No. 112—Page 265

REFRACTORY MORTARS: Laclede-Christy Co., Arcade Bldg., 812 Olive St., St. Louis—Booklet describes the company's line of refractory bonding mortars and discusses their purposes and selection, preparation and mixing.

For More Details Circle No. 113—Page 265

MATERIALS HANDLING: Webster Mfg. Inc., Tiffin, O.—Booklet commemorating the company's 75th anniversary describes facilities and products and shows installations of company products in various industries.

For More Details Circle No. 114—Page 265

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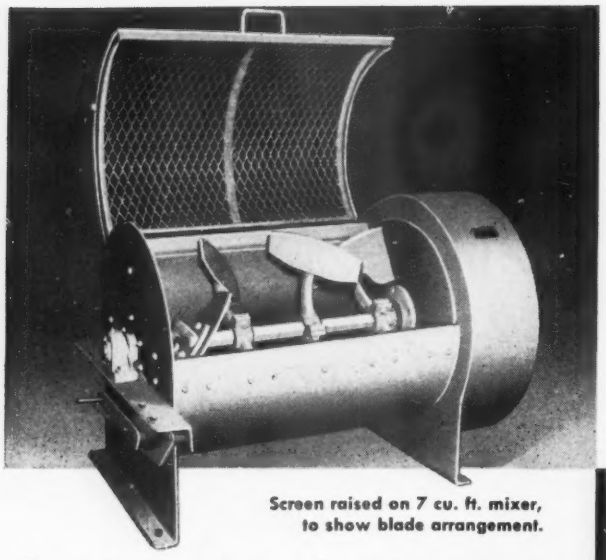

Screen raised on 7 cu. ft. mixer, to show blade arrangement.

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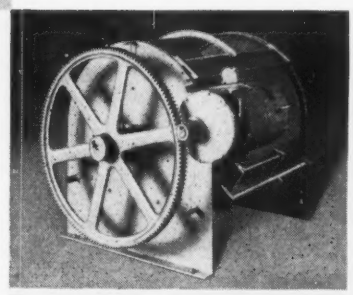

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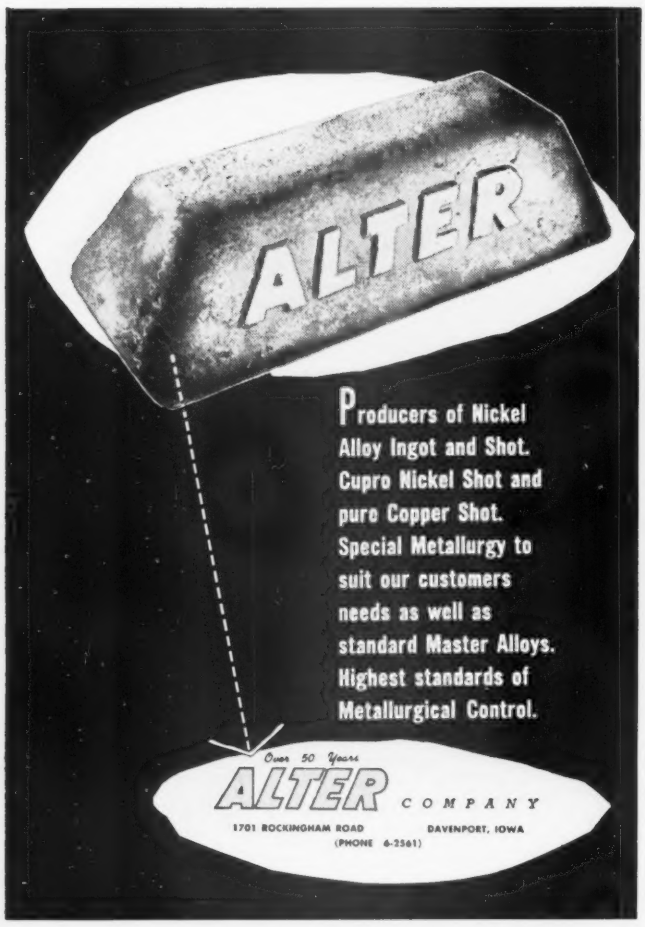

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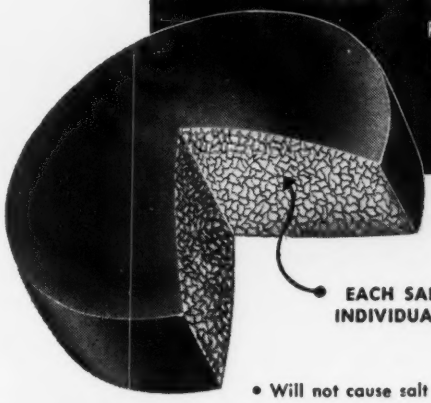

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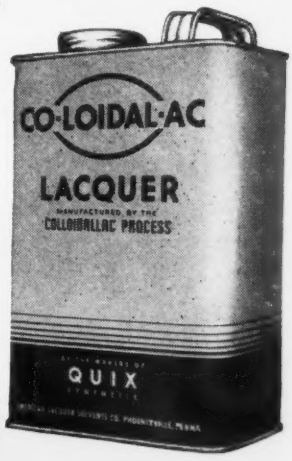

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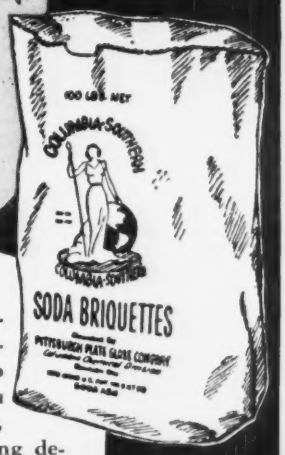

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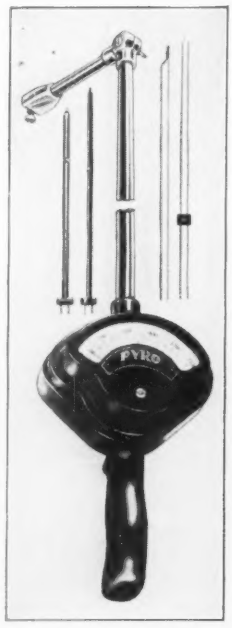

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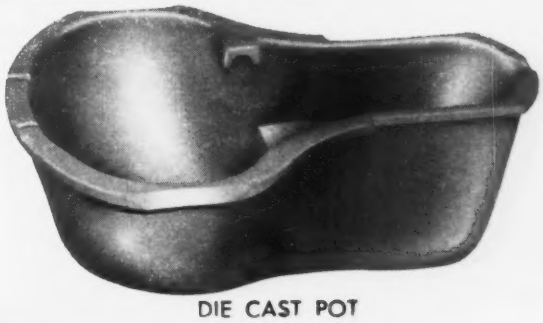

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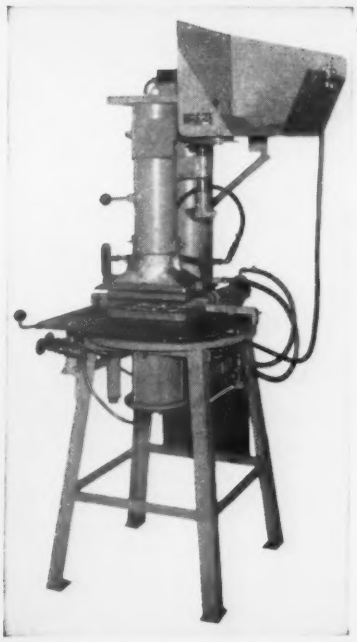

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DO MORE WORK AT LESS COST

because they deliver more power per cubic foot of air consumed, are light in weight for easier maneuverability and they retain their new tool power longer.

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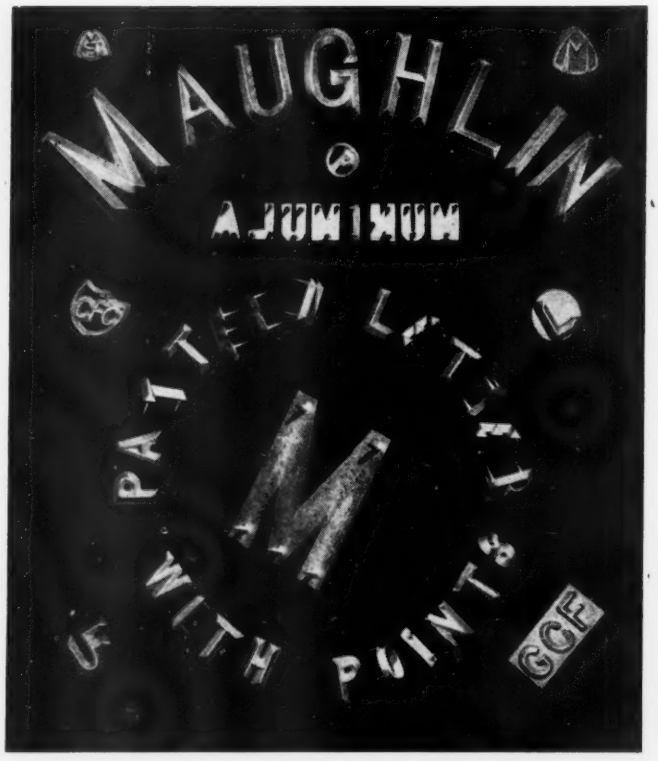
A Hammer Blow Secures Letters To Pattern



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for pattern shops

This accurate, easy-operating "Oliver" Pattern Lathe features a new principle: the stationary plate carries permanently contact plugs which are fastened to all motor wires. All power is shut off from the controller while the handwheel locates the sliding plate at any one of the four speeds desired. Made in three sizes to swing 16, 20 and 24 inches. *Write for Bulletin No. 25.*

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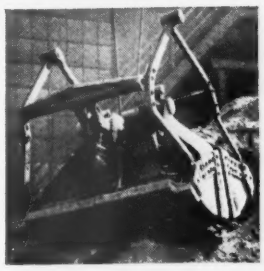
Manufactured at Terre Haute, Indiana by INDIANA GAS & CHEMICAL CORPORATION

These Four BLAW-KNOX *Buckets*
Help Solve Your Rehandling Problems for Average or Unusual Conditions

FOR AVERAGE HEADROOM

THERE is a type and size of Blaw-Knox Single-Line Hook-On Foundry Buckets to meet a wide range of operating conditions. Blaw-Knox can best give you the competent engineering service that makes possible selection of the bucket suited to your needs.

FOR EXTREMELY LOW HEADROOM

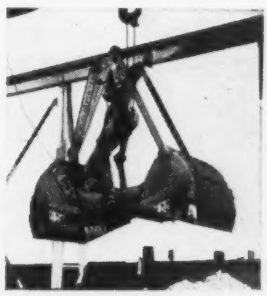


THIS Single-Line Hook-On Bucket solves rehandling problems when headroom is extremely limited. The ¾ yd. capacity bucket requires only 6'7" operating headroom. Also available in larger sizes.

FOR COKE AND SAND
"Shark Tooth" Single-Line Hook-On Buckets

HERE'S the answer to the problem of handling coke and sand . . . simply by adding or removing liner plates, the *same* dual purpose Blaw-Knox Bucket handles both, with minimum degradation of coke and without sand leakage! The illustration at the upper right shows an open head type Single-Line Hook-On Bucket, rated 1 cubic yard, with liner plates applied inside of the shark teeth for handling sand, coal, small limestone and granular fines. Illustrated at the right is a closed head type 1 cubic yard Shark Tooth Bucket without liner plates for coke handling.

Blaw-Knox Shark Tooth Buckets are available in a wide range of sizes and for different headroom conditions.



Write for Bulletin 2232 today

BLAW-KNOX DIVISION
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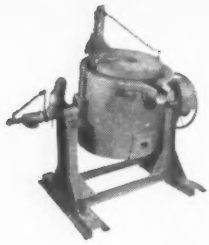
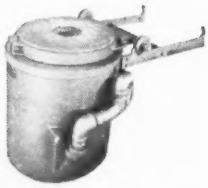
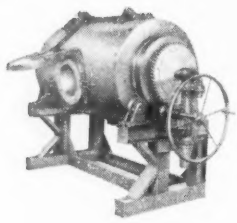
BLAW-KNOX
FOUNDRY BUCKETS



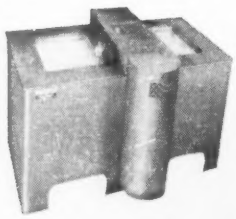


a complete line



for your

specific need



There's a specific Lindberg-Fisher furnace to exactly fit your precise melting and holding need. Whether it's gas—oil—electric—induction—arc—or high frequency—it's included in the complete Lindberg-Fisher furnace line. That's why our engineers can intelligently and without prejudice recommend the furnace to best fit your needs—regardless of type.

SEND TODAY FOR BULLETIN 551
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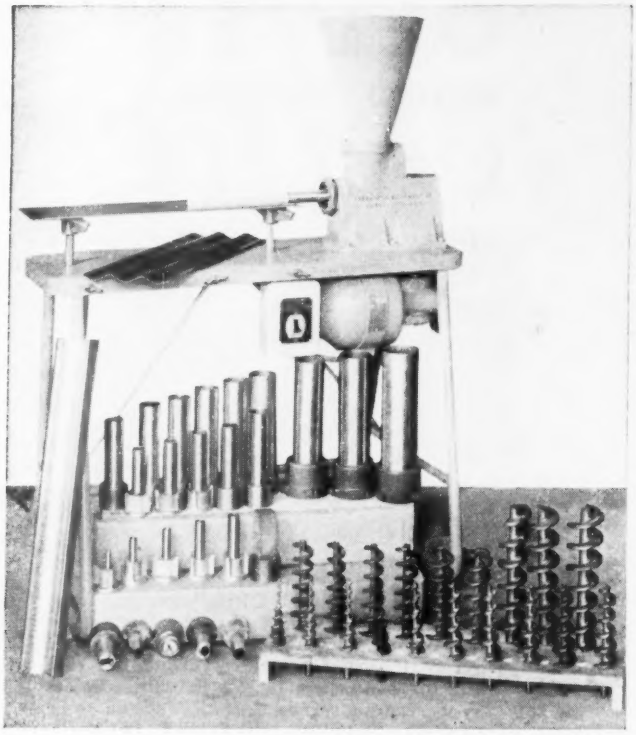

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By: **WADSWORTH EQUIPMENT CO.**

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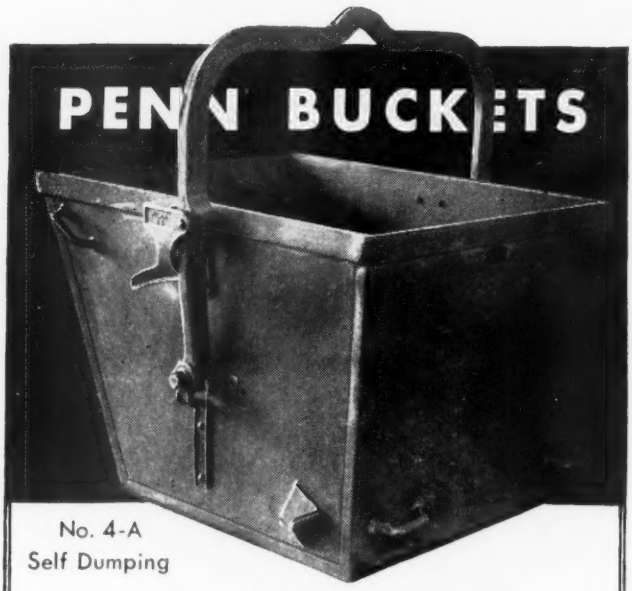

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STURDY, RUGGED ALL STEEL CONSTRUCTION

MASSIVE LINKS OCCUPYING ENTIRE SPACE BETWEEN TIEBARS ASSURE MAXIMUM LOCKING PRESSURE FOR OFF-CENTER DIES • SIX SHEAR POINTS MINIMIZE LINK PIN BREAKAGE

Hydraulic Core-Pull and Ejection Manifold mounted on movable plate. This permits core-pull cylinders to be piped in solid, eliminating all flexible hose.

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(Available in Brass or Steel)

Slot Widths: .010", .013", .015"

Diameters: 1/8", 3/16", 1/4", 5/16", 3/8", 7/16", 1/2", 5/8", 3/4", 7/8" 1", 1 1/4", 1 1/2"

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Mesh: #30, #40, #50

Diameters: 3/16", 1/4", 5/16", 3/8", 7/16", 1/2", 5/8", 3/4", 7/8", 1", 1 1/4", 1 1/2"

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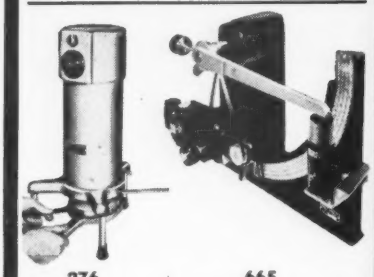
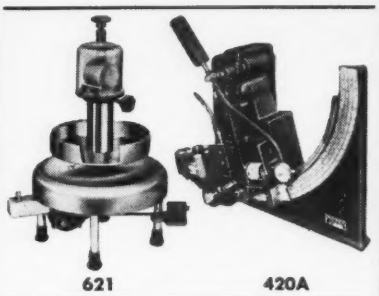
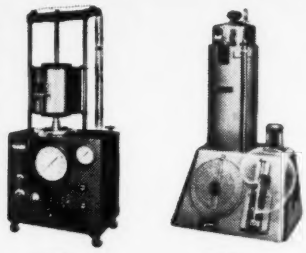
USE THIS EQUIPMENT	 276 665	 621 420A	 785 335
MAKE THESE TESTS	GREEN STRENGTH GREEN DEFORMATION FLOWABILITY MOISTURE GREEN HARDNESS	GREEN STRENGTH SAG RESISTANCE CRACK RESISTANCE BLOWABILITY STICKINESS	HOT STRENGTH HOT DEFORMATION PERMEABILITY COMBUSTIBLES FINENESS

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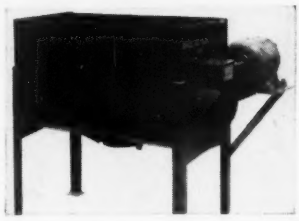
Sturdy and Dependable



3 and 6 cubic feet

Steel paddles for thorough mixing of sand or clay loam. Any capacity or height to fit your requirements.

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THE ORIGINAL METALLIC FILLER FOR FERROUS CASTINGS

Just mix with water and apply cold. Sets quickly, and to all intents and purposes becomes part of the casting. Eliminates sand holes, blow holes and minor defects—just finish off with file or emery paper. Used by large and small foundries and machine shops ... many imitators but only one Clark's Cast Steel Cement.

WRITE FOR LATEST FOLDER. Complete information as to use and uses; prices and free sample offer for testing.

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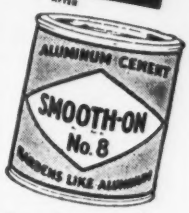
For Surface Blemishes in ALUMINUM CASTINGS

Have you used the Smooth-On Foundry Cement made especially to correct blow holes, porous and rough spots, dents and other unsightly but harmless surface defects in otherwise sound *aluminum* alloy castings?



Applied like the widely used Smooth-On *Iron* Foundry Cement, Smooth-On No. 8 *Aluminum* Cement fills in evenly, hardens quickly, matches perfectly. Stays in place, too, for it expands slightly as it sets.

Smooth-On No. 8 Aluminum Cement comes in 1- and 5-lb. sizes. 1 lb. will fill 17 cu. in. Order it by NAME AND NUMBER from your supply house. If they haven't it, write us. If you have not yet discovered Smooth-On No. 8, ask us for

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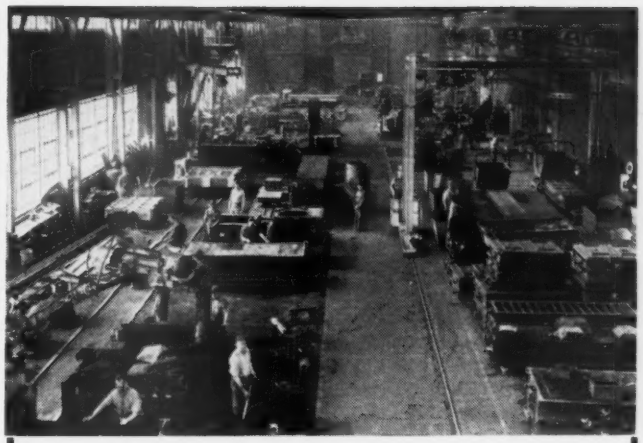

STOP DUST ECONOMICALLY

The Johnson-March Dust Control System provides positive dust control at a cost averaging less than 1/10 of other systems.

Hundreds of installations are daily eliminating dust in various foundry operations. Unlike other dust control systems, the J-M System *eliminates dust at the source,* not after it has become airborne.

In foundries, the J-M System eliminates dust from:

FLOORS and WALKS—Prevents rising of dust from dirt floors and sand heaps.

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CUPOLA STACKS—Stops air pollution by washing the gases.

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SERVING YOU
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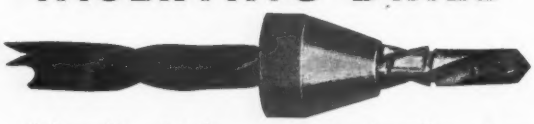
INSERTING DRILL



- Uniformity of holes
- Faster insertion of vent
- Correct Depth

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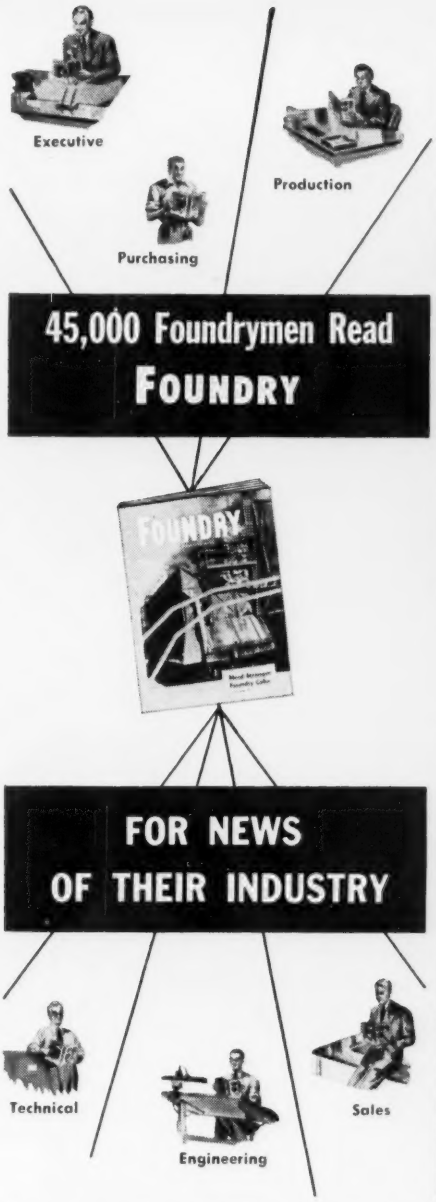
TOOLS • PRECISION MACHINED and GROUND PARTS • FIXTURES



It's easy to understand why when you realize that nowhere else can foundrymen find *so much* news about the foundry industry. FOUNDRY's editorial staff concentrates on the job of keeping foundrymen up-to-date on developments in Washington, and in the financial and industrial centers as they affect the foundry industry. Their alert reporting and timely features have helped make FOUNDRY the most influential publication in this field by providing foundrymen with facts, figures and information they can depend on. This high reader interest—cover-to-cover readership among *45,000 foundrymen*—gives your advertising the *world's biggest audience of foundrymen* every month.

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A Penton Publication
Penton Building
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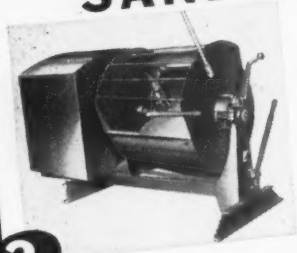

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Write for Illustrated Bulletin No. 152

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MODEL J is versatile, sturdy and easy to operate to produce economically a wide range of superior castings. It is completely integrated on a single base, readily moved as a unit, and does not require a special foundation.

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You'll get more production with these faster, more powerful rammers and at the same time substantially reduce maintenance costs.

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Send for Bulletin 300

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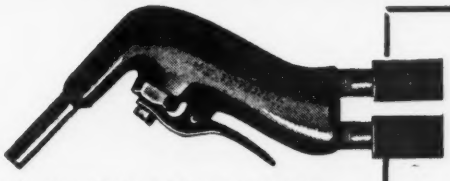

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Complete with 4½ ft. suction hose and sinker . . . **$10.00 F.O.B.** Hamilton, O. *For spraying molds and cores with any liquid. For cleaning motors and machinery. For laying dust. Trigger control. Well made and guaranteed.*

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SPRAY GUNS • PISTOL SPRAYERS

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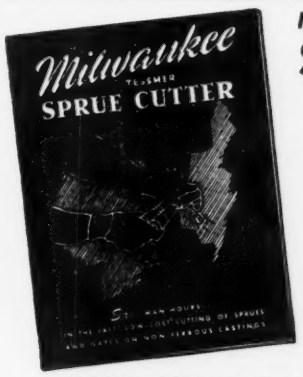

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Non-Ferrous Foundries

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- Does away with tedious hand labor.
- Speeds flow of work through cleaning department.
- Built for years of Rugged, Low-Cost Service.
- 2 Sizes, ¾" and 1¼" square. Built-in electric motor or belt drive.

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Hook the yoke over the crane hook and the bucket is ready for work. When the job is finished, take the yoke off the hook and the crane is free for other duties.

Capacities from ⅜ to 2 cubic yards. Write for free bulletin.

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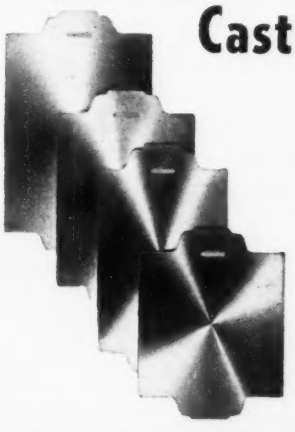

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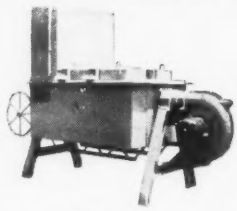

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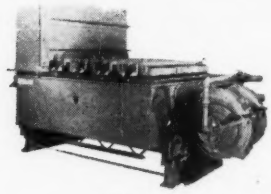

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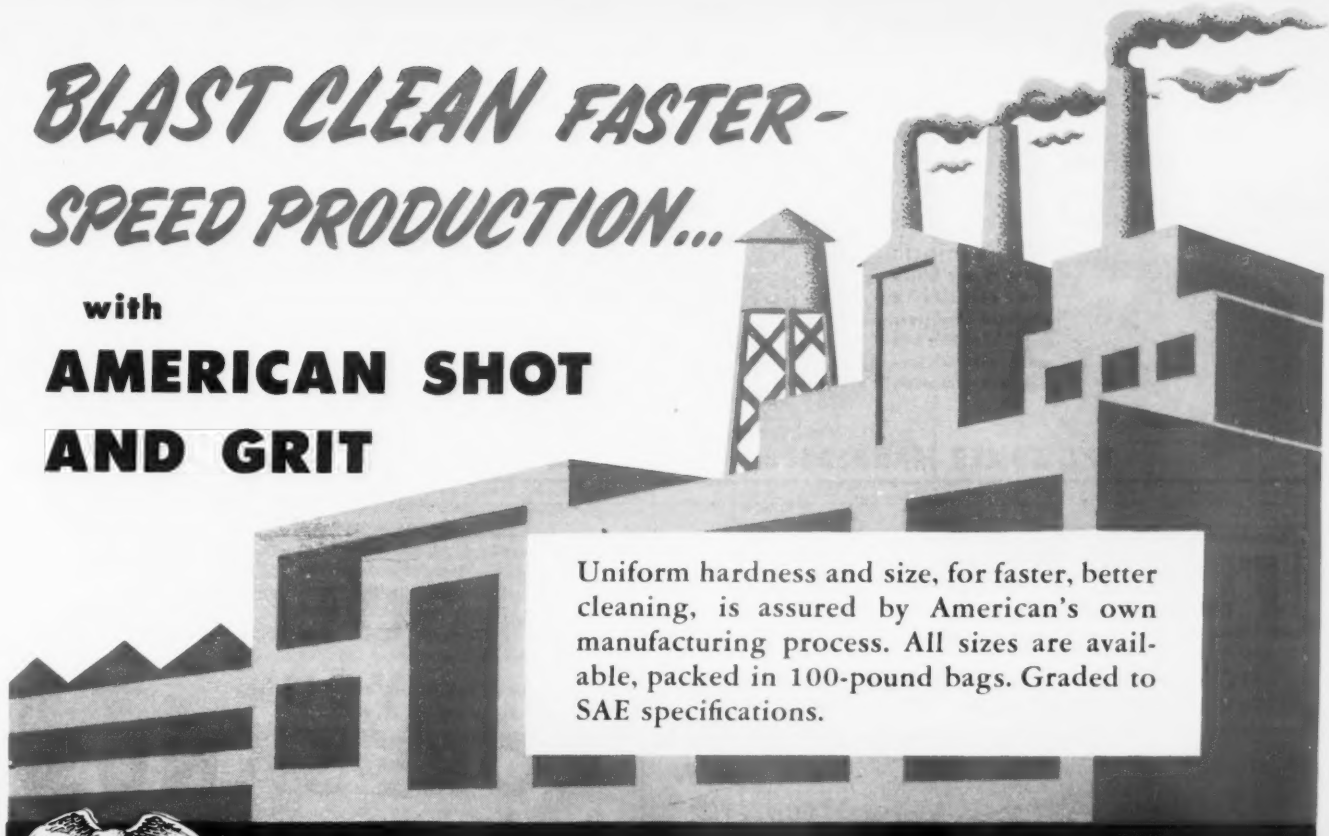

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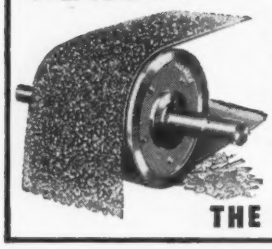

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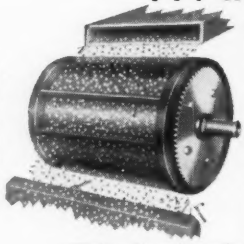

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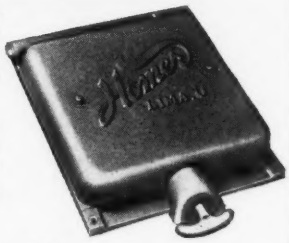

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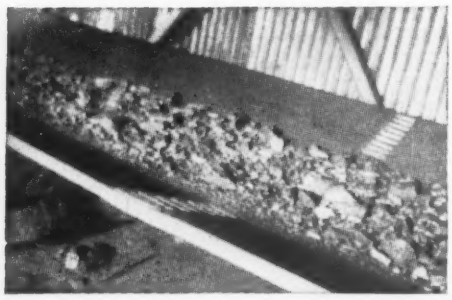

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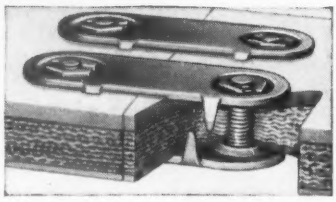

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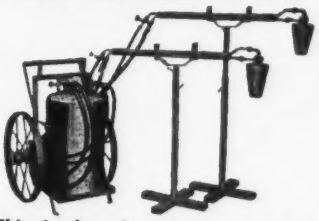

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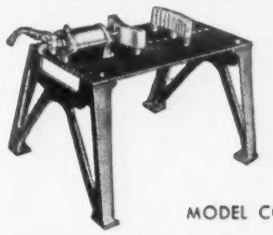

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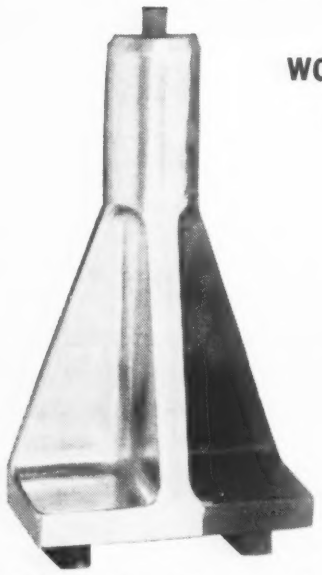

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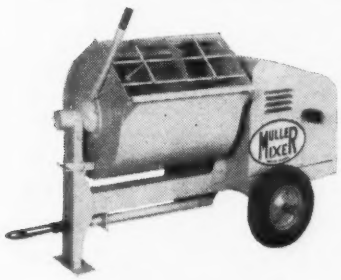

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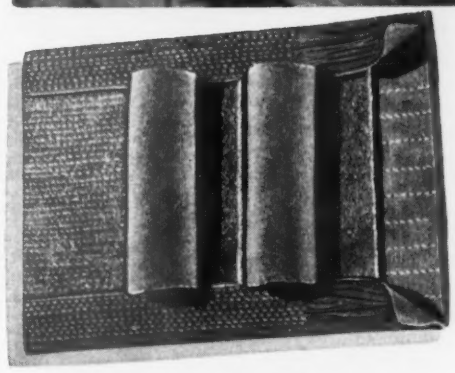

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Able to take complete charge of engineering, machine shop or foundry. Experienced in Aluminum and Magnesium. Position must be near top management. Address Box 884, FOUNDRY, Cleveland 13, Ohio.

FOUNDRYMAN

Desires position as superintendent or foreman, gray iron or nonferrous. Practical man with 26 years' jobbing and production experience. Soil pipe and fittings and farms machinery included. Address: Box 785, FOUNDRY, Cleveland 13, Ohio.

CORE ROOM FOREMAN

Twenty years' experience in core room, 15 years as general foreman. Experienced in all types of cores on blowers, bench, rollover machines in steel and grey iron. Address: Box 878, FOUNDRY, Cleveland 13, Ohio.

MANAGEMENT NOTE

Are you interested in securing an experienced practical and technical foundryman with an exceptional background in iron and steel who has used most types of equipment in various lines of castings from small to medium large. Qualified to take complete charge of your foundry. Employed. For complete details and references address: Box 994, FOUNDRY, Cleveland 13, Ohio.

FOUNDRY SUPERINTENDENT

If you have excessive burnout, hot spots, poor metal, bad castings, bad annealing and want to change, I am your answer. Foundry superintendent with complete knowledge of management, handling men, making grey iron, semi-steel, ductile, iron, malleable iron, practical experience sands, molding, coremaking, gating, pouring, shakeout, cleaning, annealing and shipping. Address: Box 890, FOUNDRY, Cleveland 13, Ohio.

SUPERINTENDENT
PRACTICAL-TECHNICAL

Progressive modern grey iron foundryman, 48, background of 27 years' experience producing quality castings. General jobbing, production in mechanized foundry. Well versed in all departments and costs, sand control, cupola, molding, cleaning, etc. Desires change—wants contact with reliable foundry. Address: Box 989, FOUNDRY, Cleveland 13, Ohio.

METALLURGICAL SUPERVISOR

Wants position with iron or steel foundry in Cincinnati or Milwaukee area. Family man, age 37, presently employed as metallurgist with very high production grey iron foundry. Address: Box 997, FOUNDRY, Cleveland 13, Ohio.

Positions Wanted

METALLURGIST (Executive)

University degrees, energetic, with long experience as executive of modern and advanced nonferrous metals smelting and refining works (Copper and Copper-Base Alloys) in Great Britain, wishes to take up similar position in U.S.A.

BOX 996

FOUNDRY CLEVELAND 13, OHIO

MANAGER—SUPERINTENDENT

Twenty-eight years of gray iron experience and some nonferrous. Outstanding practical and technical background. Have supervised as many as three hundred men, 125 tons daily, production and jobbing, mechanized or semi. Excellent cost man, ability to handle men and can obtain results. Age 47. Address: Box 991, FOUNDRY, Cleveland 13, Ohio.

GREY IRON FOUNDRYMAN

Practical, technically trained, qualified through experience in all phases of the foundry. Light to heavy work, green and dry sand. Well versed in cupola and metallurgy, cost minded, pleasant personality. Address: Box 990, FOUNDRY, Cleveland 13, Ohio.

MANUFACTURING OR SALES

Experienced as chief metallurgist of tractor works; production superintendent, sales engineer and works manager of foundry producing heat resistant and stainless castings. Desires position with progressive organization. Address; Box 987, FOUNDRY, Cleveland 13, Ohio.

SUPERINTENDENT

Practical, technically trained foundryman. Desires position with reliable jobbing foundry producing complicated castings. Well versed in sales, estimating, metallurgy and apprentice training. Fifteen years as superintendent. Address: Box 107, FOUNDRY, Cleveland 13, Ohio.

PRACTICAL FOUNDRYMAN

Ferrous and nonferrous with both practical and technical training. A-1 metal man up-to-date on light and heavy castings. Capable of taking complete charge. Good connection more important than large salary. Address: Box 101, FOUNDRY, Cleveland 13, Ohio.

CUPOLA SUPERVISION

Operation 14 years' practical experience in all phases of cupola operation, 42 years of age. Best of references. Address: Box 985, FOUNDRY, Cleveland 13, Ohio.

FOUNDRYMAN

Experience in gray iron and some nonferrous on both production and jobbing. Wide experience all phases of foundry management, cost minded, knowledge of scrap causes. Well versed in pressure castings. Salary and production bonus. Midwest preferred. Address: Box 102, FOUNDRY, Cleveland 13, Ohio.

METALLURGIST

BS degree—eight years' experience—5 years research and development—3 years' production. Experience in shell molding development, investment casting, sand foundry, induction melting. Desires to locate in midwest. Address: Box 103, FOUNDRY, Cleveland 13, Ohio.

GENERAL CORE ROOM FOREMAN

Age 45, 26 years' experience—blocks, heads, all types automotive work. Compelte knowledge in all phases of core blowing, bench and sand mixes. Employed. Address: Box 115, FOUNDRY, Cleveland 13, Ohio.

PRACTICAL FOUNDRY CONSULTANT

In nonferrous, aluminum and magnesium. Thirty-five years' experience eliminating trouble from blueprint to the finished product. Daily, weekly or monthly basis. Eastern states preferable. Address: RAYMOND R. WICKLEIN, 30C, MEADOWBROOK PLACE, MAPLEWOOD, N. J.

BUSINESS MANAGER

Mature, profit-minded, aggressive. Successfully managed five companies—three taken out of the red. Trained two successors, both made good. Qualified to carry complete administrative responsibility and develop all profitable possibilities. Excellent experience foundry, machinery and related lines. Address: Box 112, FOUNDRY, Cleveland 13, Ohio.

Positions Wanted

FOUNDRY SUPERINTENDENT

Fully qualified on large and small machine tool castings in gray iron. Good record on quality control, organizing ability, production and costs. Up to date on sand, metal and mechanization. Prefer foundry with over 200 men. Now employed. Address: Box 117, FOUNDRY, Cleveland 13, Ohio.

FOUNDRY MANAGER

Twenty-six years in machine tool foundries. Experience covers all foundry operations. Specialized knowledge of foundry cost control, incentive systems, industrial relations, production methods and organization. Foundry consultant on sand and quality control, mechanization, cupola operation and general foundry problems. Age 42, now employed. Address: Box 797, FOUNDRY, Cleveland 13, Ohio.

Accounts Wanted

SALES OR SERVICE

Our aggressive organization can sell, install and service your equipment in Wisconsin. Your customers will appreciate this personal all-round service feature. Or, we can offer our statewide maintenance service only, if your sales representation is adequate. For further information about our sales and service facilities write:

MAINTENANCE SERVICE CO.

2827 SOUTH 12TH ST. MILWAUKEE 15, WIS.

SALES REPRESENTATIVE

Experienced foundryman to represent foundry supply company in Western Ohio and Indiana. Address: Box 105, FOUNDRY, Cleveland 13, Ohio.

Opportunity

PARTNER WANTED

Opportunity for young man with foundry experience to buy part interest in fast growing Gray Iron jobbing foundry in Colorado. Have 25,000 sq. ft. floor space, railroad siding and equipment to handle any job from 1 to 10,000 lbs. Gross $300,000.00 per year. Can be doubled in the next two years. Address Box 883, FOUNDRY, Cleveland 13, Ohio.

Available Capacity

AVAILABLE CAPACITY

Pattern shop complete service. Wood and metal equipment. First class work, prompt delivery. Address: Box 110, FOUNDRY, Cleveland 13, Ohio.

AVAILABLE CAPACITY

We have open capacity in gray iron on squeezer, cope and drag, floor, crane and odds and ends. Address: **PHARISBURG FOUNDRY CO., MARYSVILLE, OHIO, R. 1.**

Wanted-To-Buy

MIXERS WANTED

Used Simpson Intensive Sand Mixers. State size, condition and lowest cash price or immediate acceptance. Address Box 578, FOUNDRY, Cleveland 13, Ohio.

WANTED

BRIDGE CRANES

ARNOLD HUGHES COMPANY

765 PENOBSCOT BLDG. DETROIT 26, MICH.

WOODWARD 1-1894

CLASSIFIED ADVERTISING

Wanted-To-Buy

WANTED

Used patterns for state of New York type manhole rings, covers, catch basins, frames, etc. Address: Box 892, FOUNDRY Cleveland 13, Ohio.

WANTED

1—Model "M" or "L" screenerator 440 volt. Must be in good condition. Address: Box 988, FOUNDRY, Cleveland 13, Ohio.

WANTED

SANDSLINGER WANTED—Junior Tractor. Address Box 656, FOUNDRY, Cleveland 13, Ohio.

WANTED

to lease idle foundry building in New York State. Must have a cupola. Condition of building or equipment secondary. Address: Box 893, FOUNDRY, Cleveland 13, Ohio.

WANTED

Hines aluminum pop-off flask, all sizes. Must be in excellent condition with aluminum jackets. Address: MARCH-BROWNBACK CO., POTTSTOWN, PA.

WANTED

Used Dietert test core baking oven in good condition. Give price, age, etc. Address: Box 104, FOUNDRY, Cleveland 13, Ohio.

WANTED

1—#4 U. S. Rotary melting furnace complete, capacity 2000 lbs. Brass. Address: IMPERIAL CANTRELL MFG. CO., JELLICO, TENN.

WANTED

Need for production—Simpson Mixer, Raymond Mill, one or two vibrating screens. Please give full particulars. P. O. BOX 1351 CHURCH STATION, NEW YORK 8, N. Y.

WANTED

Used foundry laboratory equipment and sand testing equipment. Give prices, description, etc. Address: Box 870, FOUNDRY, Cleveland 13, Ohio.

Foundries For Sale

MAGNESIUM FOUNDRY

Located small Oklahoma town. Excellent labor, no union. Building 60' x 130' with clean office. Concrete floor throughout. Excellent equipment. Immediate possession. Several good accounts presently being serviced including government work. Price $25,000. Will consider lease or profit sharing arrangement with experienced foundry manager. Address P. O. Box #121 Broken Arrow, Oklahoma.

SMALL FOUNDRY FOR SALE

On New York Central Railroad side track in Lockport, New York. Floor space of molders approximately 11,000 square feet with exceptional dumping ground for disposal of slag and waste indefinitely at lowest expense over declivity on the land. Considerable foundry equipment thrown in for the price of assessed value of the real estate. Address: JEFFERSON UNION COMPANY, LOCKPORT, NEW YORK.

FOUNDRY—GRAY IRON

Located southern Ill. town. Pop. over 10,000. Water and railroad transportation available. Labor plentiful. Foundry with 2 clear spaces 80x320, with overhead monorail. Has 2 No. 7 Whiting cupolas 72" in diameter. Contains equip. ideal for mechanized oper. Address: Box 358, FOUNDRY, Cleveland 13, Ohio.

NONFERROUS FOUNDRY

Very modern brass foundry, California Bay district. Sales for 1951—$200,000, 4 molding stations, 3 crucible furnaces, tilting type, 800 lb. capacity. Wheelabrator and automatic core oven, roller conveyors to shakeout pits to controlled synthetic sand. Cost $60,000 to replace. Price $22,750 for quick sale. Concrete building adapted for Foundry use. Will lease with option to buy. Address: Box 891, FOUNDRY, Cleveland 13, Ohio.

Foundries For Sale

FOUNDRY FOR SALE OR LEASE

On Sante Fe Railroad, located in Central Texas. Brick and metal buildings, plenty of space for expansion.

H. L. BINGMAN
5022 BRADFORD DR. DALLAS, TEXAS

FOR SALE

Small jobbing and production foundry. Ten ton capacity—fully equipped, going and established terms—Wisconsin. Address: Box 111, FOUNDRY, Cleveland 13, Ohio.

FOUNDRIES FOR SALE

IRON FOUNDRY. Jobbing foundry producing light and medium castings. Excellent labor area. Price $40,000.

BRASS & ALUMINUM FOUNDRY. New foundry with profitable operations. Priced low for quick sale.

EDWARD H. ZOLL
FOUNDRIES SOLD AND LEASED
790 BROAD ST. NEWARK 2, N. J.

FOUNDRY—GRAY IRON

Equipped foundry with plenty of storage or manufacturing space all in one building with a total floor area of 54,000 sq. ft. Concrete floor throughout, land area approximately three acres, located in Western New York. Immediate possession. Address: Box 993, FOUNDRY, Cleveland 13, Ohio.

FOUNDRY BUSINESS FOR SALE

Location south east Massachusetts. Long lease, reasonable rent. High grade accounts. This shop is well equipped for jolt squeezer, jolt stripper and jolt rollover work. Excellent core facilities and cleaning room equipment. Owner must sell due to other interests. Wonderful opportunity for several ambitious partners. Address: Box 100, Foundry, Cleveland 13, Ohio.

For Sale

FOR SALE

2—6' SIMPSON MIXERS.
4—SAND CUTTERS.
5—SPO Portable Jolt Squeeze Molding Machines, Model 110J. Cantilever type.
1—JOHNSTON & JENNINGS 815B Molding Machine. Table Size 30 x 40", 15" draw.
1—JOHNSTON & JENNINGS 610B Portable Jolt Rollover Molding Machine. Pattern Draw 10".
9—OSBORN 275J Portable Molding Machines, Cantilever Type, 10" squeeze, 3" jolt.
1—YOUNG BROTHERS CORE OVEN, double compartment. Drawers 35" wide x 64" deep.
2—EDISON ELECTRIC CORE OVENS, 6 drawers, Serial No. 444064.
1—CONTINUOUS ELECTRIC CORE OVEN, 56" wide, 31" high, approx. 45' long.
1—NEWAYGO HANDY SANDY — REDDY SANDY 2 station machine.
2—HAMMOND HEAVY DUTY DOUBLE END GRINDERS, 48" centers, 7½ HP Motor.
BLOWERS of all kinds.
HEAVY DUTY ROLLER CONVEYOR—30", 18", and 12".

UNIVERSAL MACHINERY & EQUIPMENT CO.
320 EAST BROAD STREET
SHILLINGTON, PENNA.
PHONES—READING 30311—40146.
R. B. HARRISON, MGR. FDRY. DIV.

FOR SALE

1 Type SB-7 International core blower. 10# capacity, 4" draw feature. Good condition. Priced less than half of new. $495.00. Address: CONNOR FOUNDRY COMPANY, GRAND RAPIDS, MICHIGAN.

FOR SALE

American Wheelabrator tumblast, 27" x 36" complete with electrical equipment for 220 volt 60 cycle 3 phase current. Good condition. $3500.00 F.O.B. Tulsa. Address: EMPIRE PATTERN AND FOUNDRY CO., BOX 1647, TULSA, OKLAHOMA.

For Sale

FURNACES FOR SALE

Seven used heat treating furnaces, good condition. Suitable for heat treating armor castings and 7-ton gantry crane. Available for immediate delivery. Address: BAER STEEL PRODUCTS, INC., BOX 1428, BOISE, IDAHO.

FOR SALE

Hines aluminum pop-off flasks, numerous sizes including jackets. Will furnish sizes upon request. All flasks in good condition priced reasonable. Any one interested contact: PURCHASING DEPARTMENT, RICHMOND RADIATOR CO., NEW CASTLE, DELAWARE.

FOR SALE

1—International type PK Jolt Squeeze Pin Lift 18" cylinder, 8" lift
1—International Plain Jolt—18" x 24" Table
1—Champion Core Roll-over, 16" x 8", Portable
1—1-ton Gear Ladle
1—3 HP Stand Grinder
1—2-ton Lo-Hed Hoist, 220 V., D.C.

RAY P. SCULLY
SCULLY MACHINERY & EQUIPMENT CO.
767 MILWAUKEE AVE. CHICAGO 22, ILL.
PHONE: CANAL 6-0314

FOR SALE

Tabor power squeeze, flask lift with closed head to take 13" x 18" flask. 13" squeeze piston, 4" pattern draw. Can be converted to open end head to take various size flask. Tabor plain jar, pin lift machine 600# capacity, 6" pattern draw, 12" x 12" min. pin adjustment, 28" x 29" max. pin adjustment. Address: NONFERROUS FOUNDRY, INC., FAIRVIEW VILLAGE, MONTG. CO., PA.

WHEELABRATOR FOR SALE

One only 36" American continuous Tumblast Wheelabrator, type S19-12, complete with loading conveyor. Like new, used only three months. Ideal for cleaning castings, fittings, etc. Make collect call to: PAUL HERTEL, LACLEDE 2100, ST. LOUIS.

VALLEY STEEL PRODUCTS CO.
124 SIDNEY ST. ST. LOUIS 4, MO.

FOR SALE

Hough Model HA payloader—completely overhauled recently, four tires in good condition. Standard bucket. Price $2,000. Address: NORTH SHORE FOUNDRY COMPANY, WAUKEGAN, ILLINOIS. PHONE ONTARIO 6672.

FOR SALE

USED HOUGH PAYLOADERS HA MODELS WITH HARD RUBBER OR AIR TIRES IN FIRST CLASS MECHANICAL SHAPE. PRICED RIGHT. ADDRESS: CONSTRUCTION EQUIPMENT CORP., 2118 S. 7th ST., ST. LOUIS 4, MO., PHO: SIDNEY 1070.

FOR SALE

1 Robinson Blower—Type CS—Size 22—with 15 HP GE Motor Model 324052—Type K 220-440-3 phase Motor-speed 3600—(excellent condition)—$250.00.
1 Geared Ladle with Bale—28" dia.—28" deep—on track wheels—(good condition)—$100.00.
1 Ingersoll-Rand Little David Air Hoist—5 ton—$250.00.
2 Ingersoll-Rand Imperial Air Hoists—½ ton—$75.00 each.
Steel Flasks: can be used for stacking or separate cope and drag. 14 x 14: 42 pieces, 8" deep; 42 pieces 6" deep. 16 x 16:41 pieces 8" deep; 37 pieces 6" deep; $5.00 each.
All prices f.o.b. Danville, Penna.

THE DANVILLE FOUNDRY CORP.
P.O. BOX 119 DANVILLE, PENNA.

Employment Service

EMPLOYMENT COUNSEL, INC.

"All The Name Implies"

JOHN COPE, Manager Foundry Dept.

Recruiting men for employers in the foundry industry throughout the nation. Openings in Steel, Malleable, Gray Iron and Non-Ferrous—Jobbing and Production. Salaries to $20,000.

PLANT MANAGERS	SUPERINTENDENTS
GENERAL FOREMEN	MOLD FOREMEN
CORE FOREMEN	MELTING FOREMEN
CLEANING FOREMEN	MAINTENANCE FOREMEN
PATTERN FOREMEN	METALLURGISTS
INDUSTRIAL ENGRS.	TIME STUDY ENGRS.

And all other Administrative and Sales Positions.
WRITE or CALL for registration.
Completely Confidential

SUITE 500
CHICAGO 2, ILLINOIS

7 WEST MADISON ST.,
FINANCIAL 6-2100

SALARIED POSITIONS

$3,500 to $35,000. We offer the original personal employment service (established 42 years). Procedure of highest ethical standards is individualized to your personal requirements. Identity covered; present position protected. Ask for particulars. Address: R. W. BIXBY, INC., 101 DUN BUILDING, BUFFALO 2, NEW YORK.

SALARIED PERSONNEL

$3,000-$25,000. This reliable service, established 1927, conducts confidential negotiations for high grade men who seek a change of connection under conditions assuring if employed full protection to present position. Send name and address only for details. Personal consultation invited. Address: JIRA THAYER JENNINGS, 241 ORANGE STREET, NEW HAVEN 10, CONN.

For Sale

FOR SALE

Herman—6000# series JOLT-STRIP MACHINE 48 x 54 table, 12" draw. Late.
Osborn—JOLT STRIPPER, Model 405, 21 x 53.
Osborn—JOLT ROLL OVER, Model 406, 36 x 64.
Osborn—JOLT STRIPPER, Model 406, 36 x 52.
Spencer Turbo Blower, 3500 cfm @ 40 oz. 60 hp, xp.
R-C POSITIVE BLOWER 12 x 20, 20 hp.
R-C POSITIVE BLOWER 22 x 66, 75 hp.
MIXING LADLES, 1000# cap. to 4000#.
V.C.G.-3 SUPER GYROSET SHAKE OUT, 6' x 8' deck, complete.
PKL 12 Int. JOLT SQUEEZE PIN LIFT MACHINE. Portable.
Am. SAND CUTTER, Model AA, #1111, 15 hp, 220/440 v.
Int'l. CORE BLOWER, type SB11 $750.00.
(2) CAR SPOTTERS, 5 hp, $250.00 ea.
(2) Webster & Perkins PEDESTAL GRINDERS, 1200 rpm.
Everett STAND PEDESTAL GRINDER.
15 H.P. GRINDER.
SNAG GRINDERS to 10 H.P.
AIR COMPRESSOR, Sullivan 11 x 10, 50 HP, AC motor & starter, $750.00 f.o.b.
MAGNETIC SEPARATOR—Ding's Mfg. 12" x 18", 110 V., S. Ph. motor, 2 hp., ser. R5771. $600.00 f.o.b.
FANS & BLOWERS—up to 125,000 cfm.
HOISTS, Electric, hand, air 1 to 10 ton.
CONVEYORS—all sizes and types.
CRANES—overhead & jib, all sizes.
MOTORS, SPEED REDUCERS, BLOWERS — any size.
AIR COMPRESSORS—from 1 hp up.
FOUNDRY EQUIPMENT. Send us your inquiries.

ALLIED MATERIALS HANDLING CO.
4657 SPRING GROVE CINCINNATI 32, OHIO

FOR SALE

1—Centrifugal casting machine, model C—Vertical. Mfr. Centrifugal Casting Co., Tulsa, Okla. Capacity mold 40" dia. x 20" high. Motor drive 440-60-3. 0 to 1000 R.P.M. like new.

CLARK EQUIPMENT CO.
BUCHANAN, MICHIGAN

FOR SALE

Liquid foundry parting—50 cents gallon in bulk.
RAILROAD FOUNDRY & SUPPLY CO., WALTON, KENTUCKY.

Employment Service

For Sale

FOR SALE

1—Beardsley & Piper Model 30 Speed Mullor, 3 years old
8—Nicholls #12-42-DN Molding Machines, Jolt, Squeeze, Strip, with Mold Rollout Conveyors for Maximum Size Flask 14½" x 31"
1—American Air Filter Dust Collector #36 Wet, Type 27,000 CFM
1—Ajax Model #1784-LCS, 8" x 12' Vibrating Screen
3—Model F Production Equipment Sand Cutters, 89" Wide x 69" Dia. Wheel
18—4 Wheel Steel Core Oven Trucks, 4' Wide x 9' Long x 6' High, 9 Shelves, 36" Track Gauge

THE NATIONAL RADIATOR COMPANY
PURCHASING DEPARTMENT
JOHNSTOWN, PENNSYLVANIA

EQUIPMENT FOR SALE

1—Osborn #712 Molding Machine
2—Osborn #601 Molding Machines
1—Model A.M. American Sandcutter
1—American Wheelabrator Tumblast 36" x 42" with skip hoist.
1—Milwaukee #60-B Jolt Rollover Pattern Draw Machine.
2—U. S. Johnson & Jennings #2 Jolt Squeeze Pin Lift Machines
1—27 x 36 American Wheelabrator

MARCH BROWNBACK CO., INC.
SOUTH & CHARLOTTE STS.
POTTSTOWN, PA.

FOR SALE
SAND BLAST EQUIPMENT

Wheelabrators-Tumblast size 48 x 42
Hurry, 4 more have been released for immediate sale priced 4 to $5000.00
Wheelabrator 4 Ft. Table Blast w/tables $1750.00
Wheelabrator 6 Ft. Table Blast w/tables $3750.00
Pangborn 1GF Air Tumble Bbl. 150# load cap. $250.00
Pangborn ES-207 Blast Cleaning Cabinet used for strip steel or bar stock $1750.00
Sand Blast room 10 x 10, reasonable
Sand Blast Cabinets, pressure tanks, dust collectors and blowers. All sizes.
Contact us for your sandblasting needs or any surplus sandblasting parts and equipment you have for sale.

DIAMOND SALES INC.
5654 WEST JEFFERSON
DETROIT 9, MICHIGAN

FOR SALE

Sand-Blo delux model core blower, model C-D 40-D. Used very little and in excellent condition.

THE PROOF CO.
936 EAST 72ND ST. CLEVELAND 3, OHIO

FOR SALE

Handy Sandy—standard model HS-4-G single hopper. This machine displayed 1950 Foundry Show. Used approximately 6 months—$800.00 F.O.B. Lansdale, Pa. Contact: ROLLE MANUFACTURING CO. INC., LANSDALE, PA.

FOR SALE

1—Battery of two Recirculating Coleman metal insulated rack type core ovens, each compartment 5 ft. wide, 7 ft. high, 15 ft. long equipped with North American dual gas and oil burner, complete with Leeds & Northrup controllers. Address Box #886, FOUNDRY, Cleveland 13, Ohio.

For Sale

FOR SALE

3—Tilting Swing Head cover brass furnaces, No. 300 crucible.
1—Pedestal Grinder with 5 HP. Motor.
1—Covered Worm Geared Ladle, 1000 lb. cap., made by Modern Equip. Co.
1—Whiting Slag Ladle
1—Worm Geared Covered Ladle, 400 to 600 lb for Pouring Device.
1—10 Ton Whiting Worm Gear Ladle
2—1000 lb. Worm Gear Ladles
2—2 Ton Worm Gear Ladles.
1—7 Ton Worm Gear Ladle
1—JFL International Power Jolt Foot Lift Machine.
1—JDP. International Jolt Stripper, 600 x 8
2—International "G" Machines 20 x 8
1—Osborn Bumper 24 x 36
1—International Jolt Squeezer
2—24" Elec. Riddles.
2—Gyratory Elec. Riddles.
1—American Sand Cutter Machine Size 89/70 M.
1—Sprue Cutter with 2HP. Motor.
1—36 x 54 Late Model Whiting Tumbling Barrel complete with Jones Speed Reducer & 7½ HP. Motor.
1—Jeffrey Sand Conditioner.
1—Royer Sand Conditioner.
1—Wells Metal Band Saw Type 9M42.
1—General Blower, 3 HP. Motor, 16 oz. pressure, 220 or 440, 3 phase, 60 cycle, 375 CFM.
83 Set-Truscon Pressed Steel Flasks, 15 x 20, 8 Cope, 3 Drag.
1—#42 Osborn core rollover machine.
1—3-E Demmler Core Blower.
1—#1 Demmler Core Blower.
25—Ladles from 200 to 600 lbs.
2—Mixing ladles U type, 3000 lb. capacity.
1—Fairbanks scales, 500 lb. capacity, moveable platform.

HAYNES FOUNDRY EQUIPMENT CO.
814 ADA ST. KALAMAZOO 52, MICH.

FOR SALE

TURBO BLOWERS (3 Phase, 60 Cycle)

cfm	Pressure	Make	Motor H.P.	Volts	Speed
4000	32 oz.	Spencer	60	440/3/60	
3500	40 oz.	Spencer	60	440	1800
2700	16 oz.	Spencer	20	220/3/60	1750
650	16 oz.	Spencer	10	220/3/60	3600
450	40 oz.	Spencer	7½	220	1750
400	16 oz.	Spencer	3	220/3/60	3500
PRESSURE BLOWERS (3 Phase, 60 Cycle)					
100	7" SP	Spencer	1	110/DC	3500
9100	7" SP	Sturtevant			1900
4500	16 oz.	G. E.	30	440	3600
2700	16 oz.	Nth. Amer.	20	220/440	3600
2500	7 oz.	Sturtevant	15	220/440	1800
1150	20 oz.	North Amer.	10	220/440	3160
400	43 oz.	Spencer	2	220/3/60	3500
800	8 oz.	Nth. Amer.	3	220	3600
660	20 oz.	AllenBillmyre	7½	440	3600
450	6 lb.	A&B	30	220/440	3450
340	20 oz.	AllenBillmyre	3	440	3600

MOTOR REPAIR & MFG. CO.
1552 HAMILTON AVENUE
CLEVELAND, OHIO

FOR SALE

Whiting No. 5 cupola

MT. VERNON FURNACE & MFG. CO.
MT. VERNON, ILLINOIS

FOR SALE

1—Johnston & Jennings #918 jolt—rollover molding machine 44 x 54" table.
Draw 20 inches 2800 lb. capacity.
Very good condition price $1,750.00.

SCHMELLER ALUMINUM FOUNDRY CO.
3300 EAST 87th ST. CLEVELAND 27, OHIO
DIAMOND #1-3535

FOR SALE

1—Used No. 91 Osborn core blowing machine. Maximum size core box accommodated using standard sand reservoir—15½ x 10" x 13½".

IMPERIAL BRASS MFG. CO.
1200 WEST HARRISON ST. CHICAGO 7, ILL.

CLASSIFIED ADVERTISING

For Sale

FOR SALE

MOLDING MACHINES
8—13 x 8 Tabor power squeeze flask lift machine split pattern type.
1—International 14 x 8 jolt rollover draw.
2—Deuscher Stationary jolt squeeze.
2—SPO #611B Stationary Oscillating Jolt Squeeze Strippers.
BLOWERS FOR CUPOLAS AND FURNACES
2—15 HP Spencer-Turbine 2250 CFM at 16 oz.
10—High temperature blowers 1400° F. 9000 to 15000 C.F.M.
2—#59 Connersville-Acme.
1—Connersville rotary 24 cu. ft. per rev. 6200 C.F.M.
Maxon-Premix Blowers for Gas ¼ to 1 HP.
2—5 HP 20-oz. Spencer Turbine Blowers.
2—2 HP 20-oz. Spencer Turbine Blowers.
METAL MELTING EQUIPMENT
5—1000# open flame brass melting furnaces, gas fired.
1—Hausfeld 2000# aluminum capacity furnace, barrel type, open flame, oil fired.
New 32" to 41" dia. shell cupolas made to order.
TUMBLING MILLS AND SAND BLAST
1—Pangborn Sand Blast Unit, including generator tank, shot cleaner, bucket elevator. Suitable for use with room.
MISCELLANEOUS
1—Sullivan WJ-3 2-stage air compressor, 500 cu. ft., 100# pressure.
1—Stoney crane type shakeout.
1—Dings type M magnetic separator.
1—NC-4 sand separator.
1—NB-2 sand separator.
1—#1 Demmler core blower.
2—#16 Roto-clone units complete.
25 Tons steel flasks in sizes from 26 x 26 to 60 x 60.
4—Heavy Duty Flexible Shaft Grinders 2 HP.
Complete stock of rebuilt mill and dust exhaust blowers.

CLIFTON MACHINERY COMPANY
1023 W. SIXTH ST. CINCINNATI 3, OHIO

FOR SALE

Standard Neway "Hardy Sandy" model HS-4GT complete. Neway "Reddi Sandy" with stationary grate and hopper watering device, aerator. Only in use for five months. Reasonable price. Address: Box 871, FOUNDRY, Cleveland 13, Ohio.

FOR SALE

1—Lindberg-Fisher electric induction stationary holding and melting furnace, type IM-R401S, for aluminum available for immediate delivery. Furnace rated at 40KW, 440 volts, single phase, 60 cycles. Complete with control panels, pyrometer with lead wire, thermocouple, fused panel, meter, contactor, capacitors, cleaning tools and 440 volt, 3 phase, 60 cycle blower. Like new—never uncrated. Will sell at our cost $3896.82, f.o.b. Springfield, Mass. Address: CARLSON PATTERN SHOP, INC., 616 BERKSHIRE AVENUE, SPRINGFIELD 9, MASS.

FOR SALE

Westinghouse Electric furnace with heat treating controls, maximum 1800 degree F. Despatch Electric oven—maximum 600 degree F. Address:

MARSON CORP., REVERE, MASS., RE. 8-4398. MANUFACTURERS

FOR SALE

Hough Model H.A. payloader bought in 1947. Needs new motor. Price $1250.00

WILLIAM BROS INC.,
ELKHART, INDIANA DIAL 2-3499

FOR SALE

1—#5 Whiting Cupola and charger—water cooled—$5000.
1—42" x 48" Wheelabrator dust collector and loader—used 200 hours—price $10,000.
1—Model M Screenarator used 50 hrs $750.
14—Adams cherry flasks—8 new—and
14—Fremont magnesium flasks and Sajco jackets—10 new; price 70% of new cost.
1—Redford core blower with air clamp and extra cartridge—$300.
Complete Dietert sand testing equipment.
1—#1 Simpson Muller—used—$1500.

EDISON INDUSTRIES, INC., BOX 595
SOUTH MILWAUKEE, WIS.

For Sale

FOR SALE

SPO #9336 jolt squeeze rollover molding machine and SPO #2134 stationary jolt squeeze cope molding machine, up to 28" pattern. Used little.

THE PROOF COMPANY
936 E. 72nd ST. CLEVELAND 3, OHIO

FOR SALE

Approx. 13,500 lbs. copper shot in original containers. Address: Box 116, FOUNDRY, Cleveland 13, Ohio.

FOR SALE

2—Twelve foot diameter Roto-Cast Mold Conveyors at big savings. One was a demonstrator and one a trade-in. Guaranteed like new. Our dealers can handle—or write direct. ADDRESS: ROTO CAST FOUNDRY EQUIPMENT CO., BURR OAK, MICH.

FOR SALE

Whiting square tumbling mill 30" x 30" x 60". Thickness of plate ¾"; v belt pulley drive; brass bearings. Excellent for medium size castings. Price $300 f.o.b. St. Jerome. Apply: ST. JEROME INDUSTRIES LTD., CASTONGUAY ST. WEST, TEL: 3767, ST. JEROME (TERREBONNE) QUE., CANADA.

FOR SALE

2—Milwaukee Briquetting Presses with electrical equipment. Model 350.

1—Jeffrey MT-26 Crushing Mill for turnings, with motor.

1—Logeman Scrap Bailing Press. Model 36PCX, size of box 52 x 48 x 42; complete with hydraulic pump, oil tank, operating valves.

PAUL SINOWAY
1854 W. WEBSTER AVE.,
CHICAGO 14, ILL. BRUNSWICK 8-5550

FLASKS

Sterling Wheelbarrow Rolled Steel Flasks
18 sets 46 x 50—6" cope, 6" drag
17 sets 38 x 44—6" cope, 6" drag
20 sets 32 x 48—6" cope, 6" drag
18 sets 32 x 48—6" cope, 8" drag
CONVEYOR
ALL SIZES AND TYPES
ALLIED MATERIALS HANDLING CO.
4657 SPRING GROVE CINCINNATI 32, OHIO

FOR SALE

1—5' x 8' Simplicity shake out, D2S A
1—Type "AA" American Sand Cutter, 6' between wheels, 15 HP Westinghouse motor, 220/440 volt, 3 phase, 60 cycle, 1735 rpm, good condition.
1—Johnston & Jennings, jolt squeeze, pin lift molding machine, Model #2 new, never used
1—Tabor yoke type jolt squeeze pattern draw for flasks to 36"
2—Tabor Molding machines, yoke type, jolt squeeze only, Model #20150
2—Tabor Power Roll Over Molding Machines deep draw, no jolt Model #23712-23711
1—Beardsley & Piper Swingslinger with 5 ton plate feeder for operation with 3 phase, 60 cycle, 220 volts, practically new
1—Jeffrey Sand Aerator, Type 1, Model 2245, V Belt Drive
2—U. S. Pedestal Grinders & Wheels, 1750 RPM, 18" Wheels, 1¼" Shaft
2—Whiting 3 Ton geared ladles
3—Demmler type 3D Core Blowers for large cores
1—Demmler type B-870 Core Blower for large cores
1—Osborn Core Blower, Type C-9703, Magazine 10" x 20", Model 92-4
1—Osborn Core Blower, Type J 9134, Magazine 10" x 20", Model 92-4
1—Osborn Core Blower, FS904 for medium sized cores, Model 92-4
2—Dings 16" Magnetic Pulleys
1—Wytcherly Sand Blast Machine—Tank type
1—American #2 heat treating gas furnace
1—3' x 4' Robbins Shake out
1—Blaw Knox, 1 Ton Clam Shell #52-H157-Size 311, ¾ Cu. Yd., Single Line
Assorted Slip and Snap Flasks

NATIONAL FOUNDRY CO. OF NEW YORK
2-56 SANDFORD ST. BROOKLYN 5, N. Y.
BROOKLYN 5, NEW YORK

For Sale

MECHANIZED SAND SYSTEM

(A) Vibrating Shakeout Screen—5 HP Motor 1200 RPM 5'ox8'-0" with New Sand Crate and Hopper
(B) Belt Conveyor 20" wide. 15° incline. Speed 100 F.P.M. 3 HP Motor. DV-4 Reducer 19.77:1 Ratio. 27'-10" ¢'s Belt Conv. Stearns Magnetic Pulley
(C) Aerator 400 RPM 5 HP Motor 1200 RPM at Head of Conv. B"
(D) Belt Conveyor 20" wide. 20° incline. 100 FPM. 11'-7½" ¢'s Belt Conv.
(E) C.D. Elevator 258 F.P.M. 11" wide x 6 ply Belt 10" x 6" Buckets 15¾" x 48" Casing 5 HP motor 1200 RPM S-5 Reducer Ratio 9.91:1 39"-7⅞ Boot to ¢ Head
(F) Belt Conveyor over Bin 20" wide Speed 100 F.P.M. 3 HP Motor 1200 RPM D.V.-4 Reducer Ratio 24.46:1 35'-9" ¢ Pulleys
(G) Storage Bin 80 Ton Cap. 12'-0" High, 11'-0" Wide 20'-0" Long
(H) Apron Feeder under Bin 30" wide. Speed 24.6 F.P.M. 5 HP Motor 1200 R.P.M. D.L.-6 Reducer Ratio 36.35:1. 28'-0" ¢ Apron Conv.
(I) C.D. Elevator 258 F.P.M. 11" wide x 6 Ply Belt 10" x 6" Buckets 15¾" x 48" Casing 5 HP Motor 1200 R.P.M. S-5 Reducer. Ratio 9.91:1 38'-4" Boot to ¢ Head
(J) Aerator 400 R.P.M. 5 HP Motor 1200 R.P.M.
(K) Distributing Belt Conveyor 20" wide 100 F.P.M. 5 HP Motor 1200 R.P.M. DV-4 Reducer Ratio 15.1:1, 179'-8½" ¢ Pulleys
(L) New Sand Bin 2 Ton Cap. 10'0" x 5'6" x 8'10"
(M) Old Sand Bin 2 Ton Cap.
(N) Magnetic Separator
(P) Measuring Batch Hopper 1000# Cap.
(Q) CLEARFIELD Mixer.
(R) Belt Conveyor 20" wide. 20° incline. Speed 40 F.P.M. 3 HP Motor 1200 DL-6 Reducer, Ratio 49.4:1. 16'-6" ¢ Belt, Conv.
(V) New Sand Hopper at Shakeout.
(1) 17—Sand Hoppers Cap. 1 Ton
17—Sand Plows
All structural steel to support Distributing Belt consisting of H. Col. and Structural I Beams and Channel Complete with Elevator Controls.

Complete blue prints available. Equipment located Reading, Pa. for inspection. Engineering and installation available if desired.

BOX 984
FOUNDRY CLEVELAND 13, OHIO

FOR SALE

(2) Carl-Mayer Vertical Core Ovens—42' high; 10'-6" wide; 10'-9" deep; 32 carriers; each carrier has 3 shelves; 2 upper ones adjustable
Each $10,000.00
Clearfield Sand Mixer, Model 610, new in 1948 ..... $2,500.00
#918 Johnston & Jennings Jolt, Rollover & Pattern Draw Molding machine; table size 44" x 54"; no pit necessary $1,500.00
Herman Hi Speed Rollover & Pattern Draw molding machine; 1500 lb ser. 36" x 48" $1,500.00
(2) REJ International jolt, squeeze, rollover and draw molding machines. 800 lb. cap. used very little .....Each $1,100.00
#91 Osborn Core Blower, with clamps.. $650.00
Beardsley & Piper Turntable—16'—with 6 Champion Push Off machines $3,500.00
or will sell separately

BALCHER MACHINERY COMPANY
1884 S. COMPTON ROAD
CLEVELAND HEIGHTS 18, OHIO
TELEPHONE: FAIRMOUNT 1-1186

MACHINERY FOR SALE

2—Johnston & Jennings Jolt Pin Lift. Molding Machines, 30" x 36" table, 10" draw, ADDRESS GOLD FOUNDRY & MACHINE WORKS, 1618 SOUTH OSAGE ST., INDEPENDENCE, MO.

FOR SALE

1—27" x 36" Wheelabrator, with loader. Good mechanical condition. Will dismantle when our large machine is intalled around May 15. ADDRESS: ABRASIVE ALLOY CASTING CO., BRIDGEBORO, N. J., PHONE RIVERSIDE 4-0912.

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Six ft.; wired for 220 or 440 volts; 3 phase 60 cycle. Model K, excellent condition with extra new spare parts. Address: Box 108, FOUNDRY, Cleveland 13, Ohio.

FOR SALE

2—24″ x 24′ Belt Conveyors, 5 H.P. 220/440V. 3ph. 60cy.

1—#405-79 Osborn Rollover and Pattern Draw Molding Machine.

1—#405 Osborn Rollover and Pattern Draw Molding Machine.

1—#147 Osborn Rockover and Draw Machine, for long jobs.

1—Herman Rollover floor type 20″ x 42″, 750# jolt cap.

2—"Late Type" Model 2047 Osborn Jolt Rollover Molding Machines for cylinder head core production.

3—Model 2166 SPO Jolt Squeeze Pin Lift Molding Machines.

1—#1 Demmler Core Blower—New.

1—#3E Demmler Core Blower, A-1 cond.

1—Simplicity Shakeout (Core Knock-out) 4′ x 8′.

1—Kane & Roach Wire Straightener, 3/16″ to ½″ wire, 7½ H.P., 440V. 3ph. 60cy.

1—Climax #2½ Wire Straightener, 3/16″ to ½″ wire, 3 H.P., 220/440V. 3ph. 60cy.

1—American Wheelabrator, 28 cu ft. capacity.

1—Pangborn 12 ft. dia. Tableblast complete with dust collector.

1—Dust Collector, Parsons #118 complete with 20 H.P. motor & blower.

4—Tumbling Mills, 30″ x 60″ with 15 H.P. motor 220/440V. 3ph. 60cy.

1—3 H.P. double stand grinder, belt driven.

1—40 H.P. Pennsylvania Air Compressor.

1—#5 Cupola.

2—3 H.P. Blowers for furnaces.

1—5 H.P. Blower for Furnace.

2—Micromax Instruments Leeds & Northrup Temperature Control.

1—#3 Simpson Muller, 3000# batch size, 8 ft. dia., A-1 cond.

2—Spencer Turbine Cupola Blowers with 50 H.P. motors, 220/440V., 3ph. 60cy., A-1 cond.

1—Revolving Core Conveyor Table (Busch-Lawrence) like new.

1—Fin Cleaning Machine (Ireland) for cleaning fins on castings, like new.

Various sizes of used Steel Flasks.

Various sizes of Hines Popoff Flasks and Jackets.

EUCLID FOUNDRY & MACHINE EQUIPMENT CO.
15019 Saranac Rd., Cleveland 10, Ohio Telephone—GLenville 1-1538

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Any advertisement set in all capital letters, add 50% to the above rates.

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2 inches	27.00	25.00	23.00	21.00
3 inches	40.00	36.50	33.50	30.00
4 inches	50.00	46.00	41.50	37.50
5 inches	60.00	55.00	50.00	45.00
6 inches	73.50	66.50	60.00	53.50
7 inches	82.50	75.00	67.50	60.00
8 inches	91.50	83.50	75.00	66.50
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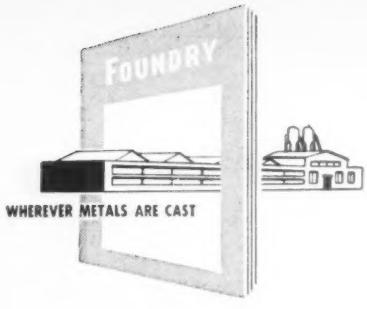
Full Page	275.00	250.00	225.00	200.00

Remittance should accompany advertisement when submitted—Cash Discount 2%, 10 days.

Classified Forms Close the 13th of Month Preceding Issue

FOUNDRY

Penton Building, Cleveland 13, Ohio



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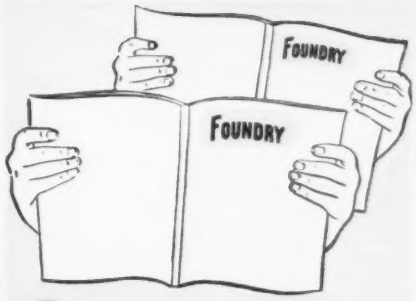

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Our continuing studies of readership show how really important FOUNDRY readers are—by title. they are:

MANAGEMENT PERSONNEL	**9,742**
Presidents, Owners	3,518
Vice Presidents	1,421
Other Officers	1,031
General Managers	3,336
Sales Managers	436
PRODUCTION PERSONNEL	**21,682**
Superintendents and Foremen	13,881
Metallurgists and Chemists	1,941
Foundry Engineers	1,662
Inspectors	309
Patternmakers	546
Purchasing Agents	1,044
Molders	1,613
Other Production Titles	686
GOVERNMENT PERSONNEL	**1,554**
EDUCATIONAL PERSONNEL	**2,050**
SERVICE PERSONNEL	**6,043**
Equipment and Supply Mfg.	4,670
Engineering Firms, Agents	1,373
ALL OTHERS	**3,953**

TOTAL . . . 45,024

Dear Reader:

We are just returned from the greatest of all foundry conventions held last week in Atlantic City—the impulse to talk about machines and materials shown there is very strong but we'd rather *people!*

We think you'd rather hear about *people*—men, for instance, like Bob Kennedy whose handsome, kindly face we are honored to associate ourselves with in our column on this occasion. We have a deep affection for the foundry industry's ageless "grand old man" as do all of you who know him. Those of you who enjoy the pleasure of Bob's warmth of friendship through frequent association in Chicago or at conventions will, we know, approve anything we can say for Bob in appreciation of his contribution to the growth of our great industry. Those of you who do not see him frequently will be happy to know that Bob was his usual active self through the convention week and is enjoying good health. He continues on active duty with Roy Schroeder at the University of Illinois (Chicago branch, Navy pier) where together they operate a growing foundry and patternshop school.

All of you who know Bob have appreciation of him for something —his years of instruction at the University of Illinois, his years of association with AFS, his inestimably important contribution to the founding and development of local chapters. For our part, we are grateful to B•b for his kindly interest and friendship of almost twenty-five years during which he introduced us to a host of other fine foundrymen. Knowing them and knowing Bob helped us immeasurably in our own personal progress.

Salutations to you, Bob . . . . and the appreciation of foundrymen everywhere for what you have done for us personally and for the great foundry industry which is our love and livelihood.

Sincerely,

Business Manager
FOUNDRY

May 8, 1952

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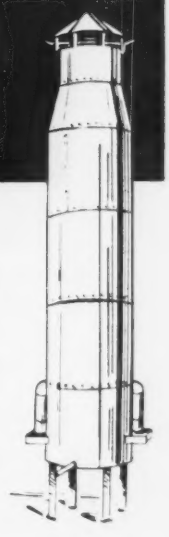
"Buffalo"

Tips on Getting the Best Service from your **Fans**

REQUIREMENTS FOR AN EFFICIENT CUPOLA BLOWER



- Strength—light weight—compact design. Heavy steel plate housing, ribbed to stand the high pressures.
- Dynamically balanced rotors of heavy steel plate, riveted or welded—narrow construction to develop pressures efficiently.

"Buffalo" TYPE "CB" PRESSURE BLOWER

—meets the requirements stated above for an efficient cupola blower. 150 cfm to 8000 cfm capacities, up to 2¼ lbs. pressure, single stage. Note compact direct drive design and overall rugged construction.

***Send For These Useful Facts on* PRESSURE BLOWING**

Bulletin 3553-A, top, contains performance ratings and construction data on "CB" Blowers. Bulletin 3014-C describes "E" Blowers-Exhausters, in capacities up to 5500 cfm for pressures up to 55" of water. Write for your copies of these bulletins, at no obligation.

FIRST FOR FANS

BUFFALO FORGE COMPANY

221 MORTIMER ST. BUFFALO, NEW YORK

PUBLISHERS OF "FAN ENGINEERING" HANDBOOK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont. Sales Representatives in all Principal Cities

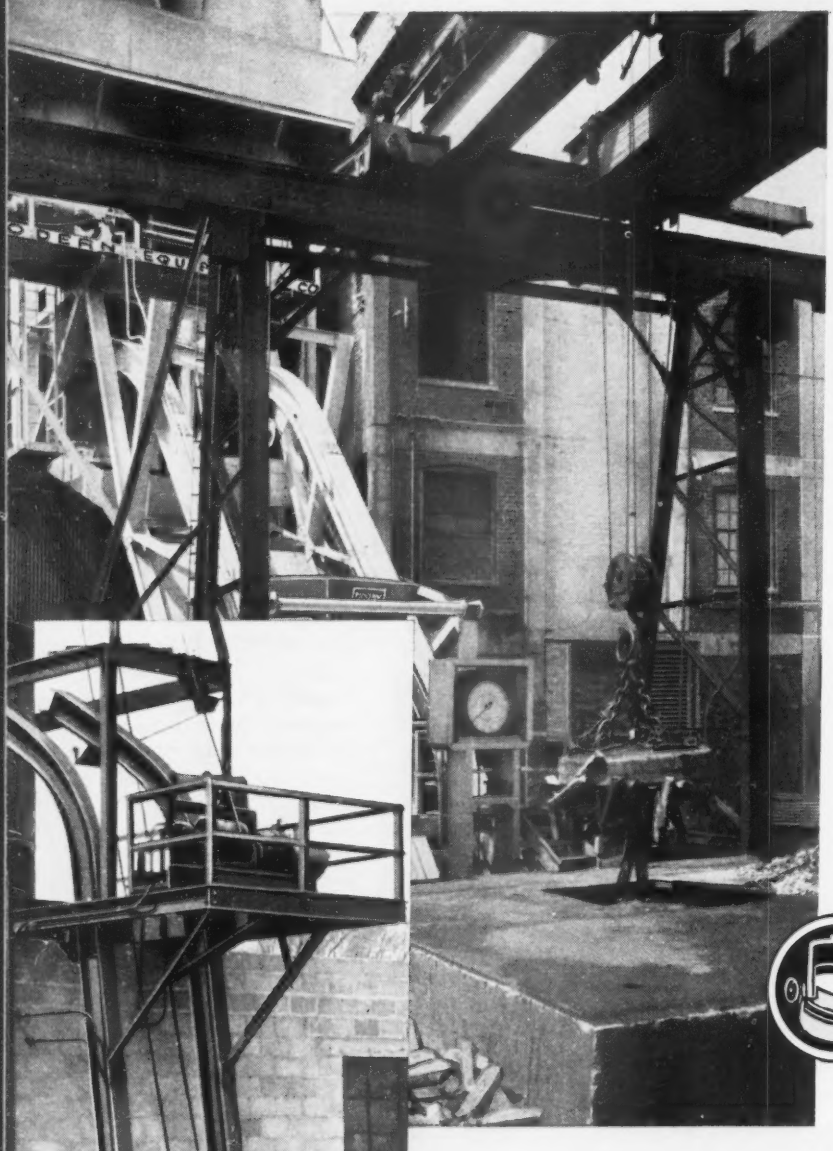
VENTILATING FORCED DRAFT | AIR CLEANING COOLING | AIR TEMPERING HEATING | INDUCED DRAFT PRESSURE BLOWING | EXHAUSTING

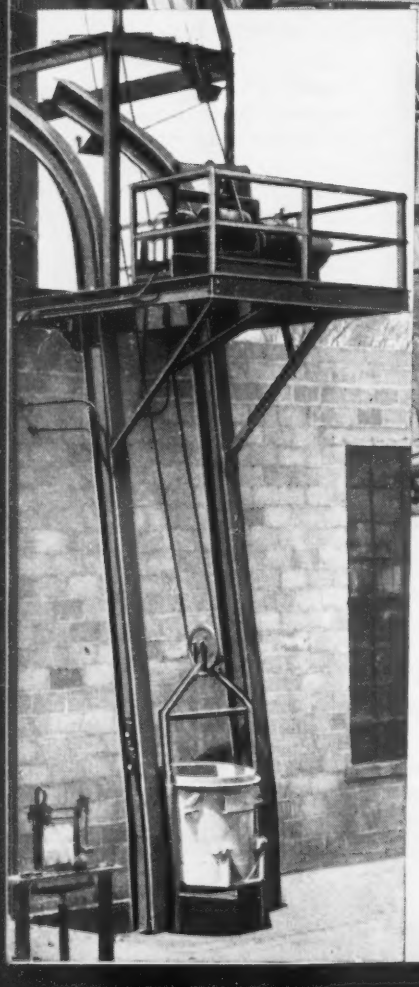
CHARGE-MAKE-UP MEN may push buttons . . .

OR, push wheelbarrows . . .

BUT the results are different!

There are marked differences in charging costs! Differences in control and supervision! Differences, too, in the quality of metal cast!





Through MODERN, push-button charging a finger-tip control is placed within easy reach of one operator. He is responsible for selecting, weighing and placing the charge in the cupola. With this uniform and accurately controlled charge, going into the cupola, there is taken out a uniform quality of metal. This improved quality of metal, alone, has been known to defray the investment in mechanical charging. Plus values are the savings in man power and improved over-all safety.

SO whether you are planning to invest $6,000 or $60,000 in your profit-boosting, mechanical charging system we invite you to figure with MODERN engineers — the men who developed the original, inclined, skip type charger. For additional planning data ask for new bulletin S-147-B. The coupon will reserve a copy for you . . .

MODERN

MODERN EQUIPMENT COMPANY
Port Washington, Wisconsin

Since designing the first, inclined, skip type charger MODERN engineers have worked together with practical foundrymen in the development of hundreds of charging systems for foundries large and small.

MODERN EQUIPMENT COMPANY, DEPT. F-6,
Port Washington, Wisconsin.

Mail to my attention:

New bulletin on SMALL-CONE charging, S-147-B ☐
Standard catalog on cupolas and cupola charging, 147-A ☐
Catalog on metal pouring systems and small ladles, 147 ☐
Standard ladle catalog, 149 ☐
Catalog on cranes and monorail systems, 150 ☐
More information on FREE use of MODERN, color, sound films ☐

Company .....

Street ..... Zone .....

City ..... State .....

Individual .....

"Specify STEVENS FOUNDRY FACINGS!"

is a remark that means much more than an order for quality materials. It means high calibre castings!

Here at Stevens we are, of course, geared to meet the daily requirements of our customers. That, however, isn't enough. There must be a continual inquiry, by skilled Stevens technicians, into ways and means for improvement of our products and services. We call this technique *Research, Development and Control.* It works . . . for us . . . and for you.

Why not take advantage of our vast experience and modern facilities today? Your nearby Stevens Representative is available for immediate consultation or you may write us direct, without obligation.

PLUMBAGOS

High heat resistance. Smoother casting surface. Castings clean easier. Easy to apply. Make shakeout faster and easier.

CORE PASTES

Have good "green grab"—high tensile strength. Will not boil or swell out of joints. A grade for every purpose.

LIQUID PARTING

Economical—gives 20 to 60 molds per application. Eliminates dust from molding areas. Ideal for patterns for plaster molds—for match plates, loose patterns or core boxes.

CORE AND MOLD WASHES

Mix easily with water. Stay in suspension. Adhere firmly. Smooth, uniform coverage. Can be applied by brush, spray or dip. Reduce metal penetration. Easy, clean peel of sand from castings.

DRY PARTINGS

Safe to use. Economical. Make pattern lifts easier. Part sand cleanly from sand or pattern. Completely waterproofed.

MUDDING COMPOUNDS

Feed easily under thumb or fingers. Will not crumble or roll up. Will not curl under heat. Will not shrink, crack or peel. Prevents fins at joints.

PITCH CORE COMPOUNDS

Reduce cost three ways—cut down amount of new core sand used; allow use of old, burnt sand and gangway sweepings; reduce amount of compound used in proportion to the amount of reclaimed sand.

SEACOAL

Uniform grain size—jet black. Gives cleaner, smoother castings, easier shakeout. A grade for every purpose.

"EVERYTHING FOR A FOUNDRY"
TRADEMARK

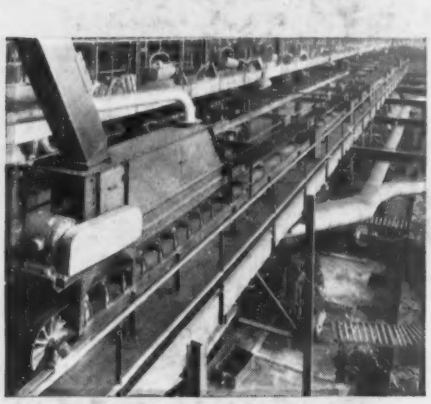
FREDERIC B. STEVENS INCORPORATED
DETROIT 16, MICHIGAN

BUFFALO • CHICAGO • CLEVELAND
INDIANAPOLIS • NEW HAVEN
Representatives in Other Principal Cities

FREDERIC B. STEVENS OF CANADA, LTD.
WINDSOR • TORONTO
ONTARIO

Above: Sand Plant in Large Gray Iron Foundry Showing Storage Bins, Weigh Hopper and Mill.

Belt Distributor Carrying Conditioned Sand to Molders' Hoppers.



Aerator on Distributing Belt in Large Mid-Western Foundry.

Sand Handling

cuts casting costs

● Bartlett-Snow Sand Conditioning systems with overhead return to the molders hoppers, synchronize and coordinate molding, pouring, shaking out and all other operations. Bottlenecks, delays and lost time are minimized. Each workman attains his maximum productive effectiveness, makes more money, becomes a happier employee, and the resulting increased output from the same floor area reduces casting costs, sometimes by as much as 33%.

35 years experience in laying out, detailing, fabricating and erecting complete or partial systems. The C. O. Bartlett & Snow Company, 6201 Harvard Avenue, Cleveland 5, Ohio.

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